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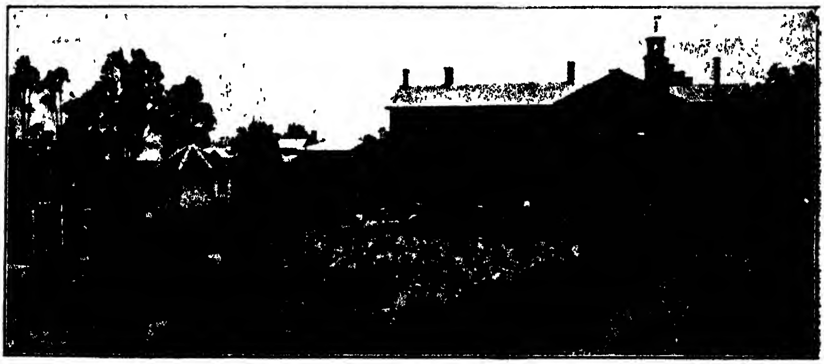
CLOSER SETTLEMENT STUDIES.

BALLARAT DISTRICT ORPHAN ASYLUM.

A. Kenny, Superintendent.

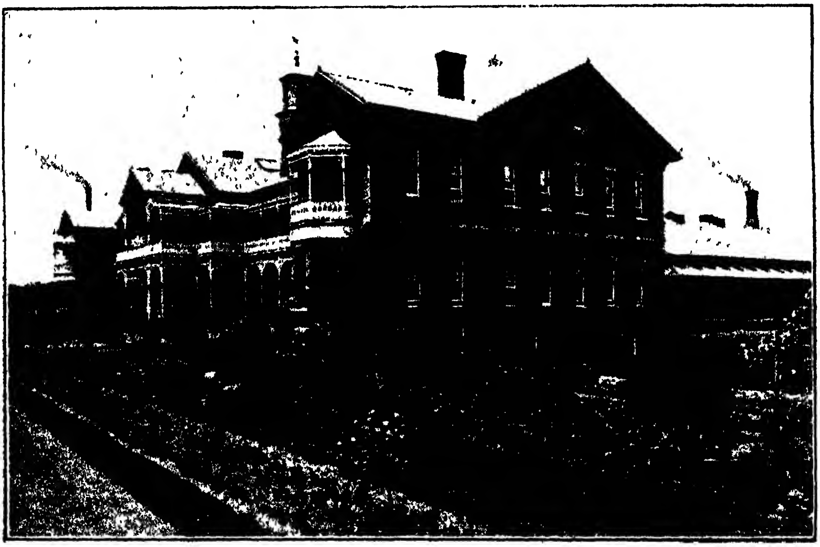


GENERAL VIEW.

As showing what can be done with a small area of worthless land by systematic energy and perseverance, there are few better object lessons than the Ballarat District Orphan Asylum. Without the advantages of irrigation, and with the disadvantages of a cold, bleak climate, and land which is generally considered absolutely worthless for purposes of agriculture, Mr. Kenny has gradually built up a small farm which, in proportion to its size, is one of the most valuable properties in the State. The work done and the methods pursued bear so directly upon the problems which have to be faced by large numbers of settlers under the Closer Settlement Acts that a short summary of the methods and results cannot be otherwise than helpful and instructive. The work has been done by the well-directed efforts of 40 to 50 little boys; and the lessons inculcated have been so well taken to heart that these boys are well known

in many districts as well-trained farm workmen, while in not a few instances they have become prosperous farmers themselves. We allow Mr. Kenny to tell his own tale.—[Ed. *Journal.*]

The Ballarat District Orphan Asylum grounds contain 50 acres divided into fifteen paddocks. It was all mining ground, three distinct rich alluvial leads having run through it. Consequently, it was full of holes, heaps of gravel, and all kinds of *débris* after the miners left it. The initial work was to level it, and fill in the holes. This was done systematically bit by bit, by the boys of the institution. It was a long, tedious job, lasting for about 25 years, but last year it was completed. After it had been levelled, it was found that there were some good flats with excellent soil, in some places 5 feet underneath the sludge, which had been run on top from the miners' puddlers. It was looked upon as folly to attempt to turn down the sludge and turn up the soil which had been buried. A small area was first started, and it turned out so satisfactorily, that little by little 12 acres have been done in this way, and



FLOWER GARDEN.

this land now, well trenched, is worth between £40 and £50 per acre. Very heavy crops of cabbages, potatoes, peas, &c., are grown year after year on this land, which was at one time quite worthless. There are hundreds of acres of similar land about Ballarat, which only require system and management to make it a source of wealth to the State.

After levelling and trenching, it was found that the soil was so retentive, and there was so much underground water, that draining was absolutely necessary before any good return could be had. A commencement was made with drains at half a chain apart, and from 2½ to 3 feet deep. There were plenty of quartz stones; these were all conserved for the purpose, and with plenty of little hands were picked up, and the small ones were placed in the bottom of the drains, the big ones in the centre, and a small size on top, and covered over with rushes and pine branches. This method makes excellent drains, which are as good to-day

as when put down twenty years ago. There is only one more paddock to drain, and that will be done this year. There are now 20 acres in cultivation.

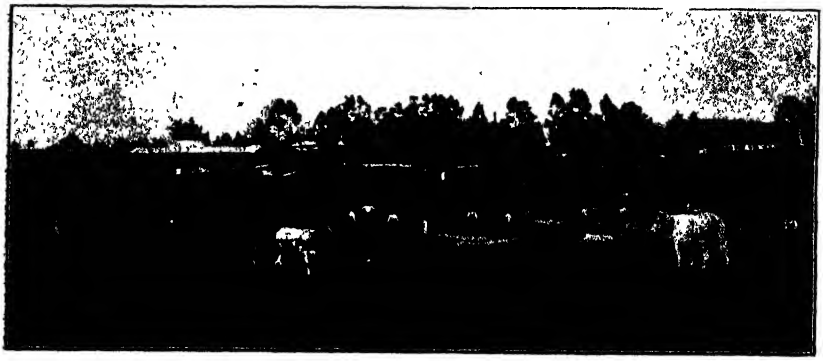
CULTIVATING POTATOES.

The principal crops grown are hay (wheat and oats mixed), maize, barley, mangolds, carrots, parsnips, peas, potatoes, and pumpkins. The largest crops are hay, mangolds, and potatoes. Two crops per year are taken off most of the land. The land is heavily manured with farm-yard manure; no artificials are used. The finances of the institution will not allow any expenditure in cash that can possibly be avoided, but we hope to be able next year to buy, say, about 20 tons of lime, which it is thought will give great results. The boys of the institution collect, in every manner possible, about 1,500 loads of manure; stable manure from the city, road scrapings, &c., are all eagerly sought after. One or two grass paddocks are top-dressed every year, and this is the making of the grass land; put on in the end of May, great results are achieved.

The general rotation carried out is to manure the grass land the year previous to being broken up; plough early in March or April, and sow with wheat and oats mixed. Second year, plough early in autumn, and sow with rape or barley and tares, whichever is the most required for green fodder: it is then heavily manured and planted with potatoes and mangolds. These crops are kept thoroughly cultivated by the boys with forks about every fortnight all through the growing season, keeping the ground clean, and well working the land. Third year, the paddock is then laid down in grass for two, or at the very most, three years, sown with $1\frac{1}{2}$ bushels of the best perennial rye-grass, a little cocksfoot, and 4 lbs. mixed clover. It is cut for grass hay the second year, and if it is not broken that year, heavily top-dressed. The grass hay we find excellent for the milking cows during the winter, especially when the cattle are fed with mangolds. A large quantity of mangolds are grown for winter feed, the crop running about 60 tons per acre.

The stock on the land at present consists of ten milking cows and fifteen head of young cattle, all our own rearing; two horses, and one pony. The cows are a cross between the Shorthorn and Ayrshire, which is found to be the best suited for the land. An average of 50 quarts of milk is kept up all through the year. Sufficient is separated to keep

the place in butter (30 lbs. per week being required). All the vegetables and potatoes are grown for 200 inmates, and the surplus sold. Last year the crops realized £90 7s. 9d., and a clear profit of £60 was made from pigs in addition. The value of the vegetables and potatoes supplied to the house was approximately £280.



THE DAIRY HERD.

SYNOPSIS OF THE MILK AND DAIRY SUPERVISION ACT 1905.

2. This Act shall come into operation—

(*a*) as regards the Metropolitan milk area and the milk areas of Ballarat, Bendigo, and Geelong, on the first day of July, 1906, and

(*b*) as regards any other milk area or Municipal district on such day as the Governor in Council shall fix.

3. Interpretation clause. The following are the most important:—

"Animal" means any animal of the kind to which any of the following belong, viz.:—Cow, dog, pig, horse, donkey, goat, or sheep.

"Butter-fat" means the pure fat of milk.

"Dairy" means any premises (not being a dairy farm or factory) where milk is kept for sale or where any dairy produce is prepared for sale.

"Dairy farm" means any premises where cows are milked or kept for the purpose of producing milk either for sale or for preparing any dairy produce for sale, and includes the animals thereon.

"Dairy produce" means milk, cream, butter, cheese, concentrated or condensed milk or cream, or any article derived or prepared from milk or cream.

"Factory" means any premises (not being solely a dairy farm or dairy) where cream butter cheese or any dairy produce is prepared packed canned or manufactured for sale, and includes creamery.

"Milk" includes any article purporting to be milk.

"Owner" includes occupier or person in charge, or apparently in charge, owner's agent or manager and in the case of a company the manager secretary or other controlling officer thereof.

4. Repeals the provisions of the Health Acts having reference to milk and dairy supervision to the extent to which they are inconsistent with this Act, but this Act does not repeal supersede or limit the operation of any enactments providing for the sale of food in a pure and sound state, or the prevention of the sale of adulterated or unwholesome food or drink.

5. This Act shall be administered by the Minister of Agriculture.

6. In any municipal district outside a milk area and which at the request of the Council thereof has been proclaimed as a municipal district subject to the provisions of this Act, all powers authorities and duties by this Act conferred on the Minister shall if not inconsistent with the context be exercised and executed by the Council thereof, and all necessary licences shall be issued by the said Council. The Council of such district shall subject to the approval of the Minister appoint and pay such supervisors as are necessary. Two or more such Councils may subject to the approval of the Minister appoint the same person as supervisor. No person shall be appointed by a Council or Councils as a supervisor unless he is qualified to be selected and appointed a supervisor by the Governor in Council, and when required to do so he shall forward copies of all reports to the Minister.

7. Provision for Council being superseded if the Minister is satisfied that the Act is not being carried out.

8. Provides for the appointment of officers. These include the chief veterinary inspector and the chief dairy inspector. Subject to the Minister the inspectors shall control supervise and direct the supervisors in carrying out their duties.

9. There shall be appointed by the Governor in Council such and so many supervisors as the Governor in Council shall from time to time determine,

The supervisors shall not be subject to the Public Service Acts. Each supervisor—

(*a*) shall be appointed under a specific contract with him for one year, but shall be eligible for re-appointment from time to time, and he may be at any time removed by the Governor in Council;

(*b*) shall be selected after a written and practical examination by examiners appointed by the Governor in Council. In such examination special importance shall be attached to the practical part. In lieu of the written part of the examination the Governor in Council may accept any prescribed public examination;

(*c*) shall be paid a salary at a rate of not less than One hundred and fifty pounds per annum; and

(*d*) shall have a district assigned to him annually.

10. It shall be the duty of each supervisor—

(*a*) to become personally acquainted as far as possible with every owner of a dairy farm dairy or factory and the conditions of every dairy farm dairy and factory in his district;

(*b*) to confer with or advise such owner on matters connected with his farm animals premises utensils milk and dairy produce when requested to do so or when instructed to do so by the Minister;

(*c*) to inspect and examine all premises utensils and appurtenances and also all animals and their food and water supply and also all dairy produce at such dairy farm dairy or factory in such manner and by such means as may be prescribed;

(*d*) to make such other inspection examination inquiry or investigation as may from time to time be directed by the Minister; and

(*e*) to report to the Minister the results of inspections in such form as the Minister may require or as may be prescribed.

11. The annual amount payable for a licence shall be—

(*a*) for a dairy farm such sum as may be prescribed but not exceeding sixpence per cow.

(*b*) for a dairy or factory such sum as may be prescribed but not exceeding in each case two pounds.

(*c*) for each creamery attached to a factory such sum as may be prescribed but not exceeding five shillings.

In computing the number of cows to be paid for, the fee shall be based on the highest average number of cows milked in seven consecutive days during the twelve months immediately preceding the application for the licence.

Where the provisions of this Act are administered by a Municipal Council the fees shall be fixed and collected by the said Council subject to the approval of the Minister and such fees shall be applied by such Council towards the expenses of administering this Act.

12. Within one month after the coming into force of this Act in any municipal district and thereafter in the month of June in each year the owner of a dairy farm dairy or factory shall make application for a licence and pay the fee to the municipal clerk or treasurer of such municipality or to a supervisor.

Where a licence is required for a period less than twelve months there shall be paid one-twelfth part of the annual fee for every month.

After a dairy farm dairy or factory has once been licensed, a licence shall be issued for any succeeding year until the receipt of a report from the supervisor showing to the satisfaction of the Minister that the place is not in a suitable and sanitary condition.

When a licence is refused the applicant shall have his fee refunded to him. Any owner who has applied for a licence and paid the fee therefor shall unless and until his fee is refunded to him be deemed to hold a licence.

13. The owner of a dairy farm dairy or factory shall when so requested by a supervisor furnish such assistance by information or otherwise in regard to the dairy farm dairy or factory and all receptacles appliances or machinery used in the business as may be required for effectively carrying out the provisions of this Act. Every owner of a factory shall furnish monthly returns to the Minister setting forth the number of suppliers the quantity of milk and cream purchased, the quantity of butter manufactured and the total sum paid for the same.

The owner of a dairy or factory shall when requested furnish the name and address of any person supplying dairy produce.

14. Boundaries of the Metropolitan, Ballarat, Bendigo, and Geelong milk areas.

15. On the recommendation of the Minister any portion of Victoria may be proclaimed a milk area by the Governor in Council, and the boundaries of any milk area may from time to time be altered extended or reduced by the Governor in Council.

16. There may be established and maintained by the State or by any Council in any milk area or municipal district a model dairy farm or dairy.

17. Any supervisor may prohibit for a period not exceeding two weeks the use of any cow for the production or preparation of dairy produce for sale, if such supervisor is of opinion that such dairy produce would be deleterious to health, and he may brand such cow with a brand which is not of a permanent character. The Minister or Council shall confirm or cancel or modify such prohibition, and the owner may appeal to the Minister against any such prohibition.

Where such prohibition is made permanent the cow may be ordered to be branded in such permanent manner as may be prescribed, and the Minister shall notify the owner of his decision as to such permanent branding and such decision shall be final and conclusive.

18. When a written notice is forwarded to the owner of a dairy farm setting forth that the use of a cow for production of dairy produce is prohibited, the owner shall at once prevent the use of such cow during such time or permanently (as the case may be).

19. Any supervisor may use any means which may be prescribed for the purpose of ascertaining whether any cow is affected with any disease requiring any cow to be isolated or branded under this Act or is in such a condition as to be likely to yield unwholesome milk.

Certain methods of diagnosis shall only be made by or under the direction of an officer who is a registered veterinary surgeon.

20. The following shall be notifiable diseases of animals under this Act :—

Anthrax,
Black leg or symptomatic anthrax,
Contagious mammitis,
Contagious pleuro-pneumonia,
Contagious abortion,
Swine fever,
Tuberculosis,
Variola vaccinia, and
Any disease which may from time to time be proclaimed by the Governor in Council by order.

21. When any animal is affected with any notifiable disease the owner shall immediately notify the fact in writing to a supervisor or a member of the police force and in the notice shall state—

(*a*) his name and address,

(*b*) the address of the dairy farm or dairy where such disease exists,

(*c*) the kind of animals and number of animals affected with such disease,

(*d*) the name of such disease, and

(*e*) any action that has been taken in pursuance of the provisions of this Act with regard to every such diseased animal.

The owner shall at once isolate any such animal.

The word " isolate " means the keeping of an animal in a separate enclosure in such a manner as to prevent actual contact of such animal with any cow being used for the production of milk or cream for sale or with any animal having contact with such cow.

Every registered veterinary surgeon or other person treating animals for disease upon it coming to his knowledge in the course of his practice that any animal is suffering from or is affected by any notifiable disease shall at once notify the Minister of such occurrence.

A fee of Five shillings shall be paid to the owner or veterinary surgeon for such notification if the report is correct. Only one such fee shall be paid in respect to any single outbreak of such disease.

22. When any person residing or employed at a dairy farm dairy or factory is affected with any contagious or infectious disease the owner shall immediately on such occurrence coming to his knowledge forward a written report to a supervisor or to a member of the police force.

Such owner shall immediately prevent the affected person from milking feeding attending handling or otherwise coming in contact with any cow producing milk for sale and from entering any room containing any dairy produce for sale and from touching or handling milk utensils or milk for sale at such dairy farm or dairy or factory.

23. No person (*a*) who is affected with any contagious or infectious disease, or who has within the previous twelve hours been in contact with any person so affected, or who is affected with eruptions or ulcerations or discharging wounds of the skin of the face hands or arms; or

(*b*) who has within the previous twelve hours been engaged in handling any animal or carcass affected with any notifiable disease under this Act and has not taken the prescribed precautions for disinfection; or

(*c*) who is employed in connexion with night-soil or any other substance declared to be noxious for the purposes of this section by the Governor in Council,

shall milk any cow used for the production of milk for sale or shall touch or handle milk utensils or milk for sale or shall enter a room containing milk for sale unless authorized by a written certificate from a medical practitioner or from the Minister or a supervisor.

No person shall sell any dairy produce in regard to which any person affected or employed as described in this section has in any way contravened this section or any dairy produce that has been stored in any room that has been entered in contravention thereof.

24. Subject to this Act any supervisor may at all reasonable times—

(*a*) enter inspect and examine any dairy farm dairy or factory and inspect and examine all the animals dairy produce and utensils; or

(*b*) take samples of such dairy produce or of water or fodder supplied to animals or of any materials used in connexion with the preparation of any dairy produce; or

(*c*) open at any dairy farm dairy factory or at any railway or tramway station or premises or in any vehicle any package which contains or is suspected to contain any dairy produce and take samples of the same. For such samples reasonable remuneration shall be offered.

25. If after inspection any supervisor is satisfied that—

(*a*) any dairy farm dairy or factory or vehicle is unclean; or

(*b*) any utensil machinery apparatus or work at any dairy farm dairy or factory is in an unclean or unwholesome condition; or

(*c*) any animal at a dairy farm is affected with a notifiable disease; or

(*d*) any person is affected with disease so that any dairy produce is likely to be contaminated; or

(*e*) the water used in connexion with a dairy farm dairy or factory is unwholesome,

he may by writing under his hand addressed to the owner of the dairy farm dairy factory or vehicle or to the consignor of the dairy produce as the case may be without further name or description—

(*f*) order such dairy farm dairy factory or vehicle and all such utensils machinery apparatus or works as the case may be to be forthwith cleansed disinfected and rendered wholesome to his satisfaction;

(*g*) order the supply of water to be discontinued and a supply of wholesome water to be used;

(*h*) order the removal or isolation of any person affected with disease, provided that the supervisor shall first obtain the certificate of the health officer of the district that the disease with which such person is affected is a disease or condition proclaimed under this Act;

(*i*) forbid the removal from a dairy farm dairy or factory of any dairy produce or any utensils for such time as he thinks necessary; or

(*j*) with respect to animals exercise all or any of the powers conferred upon him by this Act.

26. If any supervisor is satisfied that—

(*a*) any dairy produce inspected by him is unfit for human food; or

(*b*) is being or has been removed sold or delivered contrary to this Act,

he shall seize the same.

Any dairy produce which has been seized under this section shall be forthwith placed in a cool chamber if such is available and kept therein at as low a temperature as practicable pending the decision of any legal or other proceedings.

27. Where any dairy farm dairy or factory is newly established or where the buildings and premises are being altered or extended, such buildings and premises shall be constructed altered or extended in accordance with such requirements as may be prescribed.

So far as regards any dairy farm dairy or factory the Authority may from time to time give notice to the owner to take means for the better construction and drainage of the buildings and premises and for the proper disposal of all drainage.

In this section the words "buildings and premises" include dairy, milk room, separator room, factory, cow yards, bailing up yards, cow sheds, and milking sheds.

28. Where in pursuance of the last preceding section any expense is incurred by any tenant, such expense as between landlord and tenant shall in the absence of any agreement expressly negativing the provisions of this section be payable in the proportions following:—

(*a*) In case the interest of such tenant at the time such expense is incurred be less than for a term of five years, the whole expense shall be payable by such landlord;

(*b*) If for a term of five years and less than for a term of eight years three-quarters shall be payable by the landlord and one-fourth by the tenant;

(*c*) If for a term of eight years and less than for a term of twelve years, half shall be payable by the landlord and half by the tenant;

(*d*) If for a term of twelve years or upwards, the whole of such expense shall be payable by the tenant;

(*e*) But if the tenant whose unexpired interest is less than twelve years begins dairying without the written consent of the landlord, he shall bear the whole expense.

If any such landlord or such tenant pays more than his proper proportion of such expense he may recover the excess from his tenant or landlord

as the case may be as money paid to his use, and any tenant may set off any sum recoverable by him under this section against any rent payable to his landlord.

29. Where notice is served on tenant to improve buildings or to provide a proper yard, &c., such tenant shall inform the landlord who may effect the improvements himself if he elects to do so. Such notice must be in the prescribed form.

30. Any person who feels aggrieved by any order or decision of a supervisor under this Act other than in relation to diseases of animals may on giving to such supervisor the prescribed notice in writing of his intention so to do within seven days appeal therefrom to a court of petty sessions.

31. The Governor in Council may as regards any milk area, or as regards any municipal district on the application of the Council –

(*a*) prohibit any person keeping grazing or milking cows on any parts of such area or district; and

(*b*) determine the distance from the site of any noxious trade within which no cow shall be housed or kept and no milking be carried on; and

(*c*) prohibit any person keeping for the production of milk for sale any cow that is either habitually depastured on or has unrestricted access to any street.

This section comes into force at once for the whole of Victoria.

32. Except as herein otherwise provided, no person shall sell store or keep for sale—

(*a*) any dairy produce seized by a supervisor;

(*b*) any dairy produce which is unfit for the food of man;

(*c*) any dairy produce which has been drawn or derived from a cow that is known to or suspected by such person to be diseased or that has been isolated in pursuance of this Act;

(*d*) any dairy produce from any dairy farm on which any animal required by this Act to be isolated is not isolated;

(*e*) as milk anything which is not the normal product without addition or subtraction of the healthy udder of an animal unless it is sold or supplied on a butter-fat test;

(*f*) as milk anything which is not pure milk unless it is sold or supplied as separated milk with the full knowledge and consent of the person to whom such milk is sold or supplied;

(*g*) any butter which is or purports to be factory butter and which contains less than a prescribed percentage of butter-fat or more than a prescribed percentage of water provided that in no case shall the proportion of butter-fat be less than eighty per centum nor the proportion of water be more than fifteen per centum;

(*h*) except as prescribed, any article under the names "skimmed milk" "boiled milk" "sterilized milk" "pasteurized milk" "frozen milk" "thawed milk" "humanized milk" "condensed milk" "concentrated milk" "dried milk" "desiccated milk" "milk powder" or under any designation purporting that the same is milk or cream that has been treated in any way; or

(*i*) except as prescribed, any milk to which anything foreign has been added.

33. All milk or cream purchased by or for a factory or by or for any person for the purpose of being manufactured into butter or cheese shall

be purchased on the basis of its butter-fat contents as determined by the Babcock or some equivalent test approved by the Minister and with such other conditions as may be prescribed, and account sales of such purchase shall be rendered to the vendor and shall set forth the number of pounds of butter-fat contained in such milk or cream for which payment is being made. Any vendor of milk or cream shall have the right to have his milk or cream tested in his presence at the factory not oftener than once a week. This section shall come into operation in every part of Victoria immediately on the passing of this Act.

34. The Governor in Council may make regulations which may vary in their application according to time and place for carrying out all the provisions of this Act.

35. Simplification of proof in certain cases of legal proceedings.

36. In the event of any cows being isolated by a supervisor so as to prevent the supply or sale of milk from such cows the owner shall be indemnified from the payment of any damages claimed for breach of contract so far as such cows are concerned.

37. On receiving satisfactory security the Minister is authorized out of any moneys available for the purpose to advance a sum not exceeding Twenty Pounds to be expended on the better construction and drainage of buildings.

Every such advance shall be repaid in equal yearly or half-yearly instalments, and shall be wholly repaid within a period of five years, and shall bear interest at the rate of Four and a half pounds per cent.

38. Notice of seizure of dairy produce to be sent at once to owner or consignor.

39. Portion of sample of produce, &c., seized to be sent to consignor or consignee.

40. Power of officers to prosecute for offences against this Act.

41. Liability of occupier or agent in case the owner cannot be found.

42. Service of notices.

43. Continued operation of orders and notices on subsequent owners to the same extent as if they had been served originally.

44. Every person shall be guilty of an offence against this Act who—

(*a*) furnishes any certificate report or account sales which is not to the best of his knowledge and belief true and correct in all particulars; or

(*b*) replies falsely to any officer in reply to inquiries or refuses to render assistance required of him under this Act; or

(*c*) removes from a dairy farm any animal for the purpose of preventing examination of such animal or who fails to produce or submit for examination as required by this Act any animal intended for the production of any dairy produce for sale; or

(*d*) without permission of an inspector or supervisor removes from any dairy farm any animal that is required under this Act to be isolated or that is branded in pursuance of this Act; or

(*e*) in constructing altering or extending buildings or premises at any dairy farm dairy or factory fails after notice to comply with any regulation; or

(*f*) fails to comply with any notice or order made pursuant to this Act by the Minister or any inspector supervisor or officer; or

(*g*) does not hold a licence although required by this Act to hold a licence; or

(*h*) is guilty of a contravention of any of the provisions of this Act or of any Order in Council or regulation thereunder for which a penalty is not expressly provided.

Every person who is guilty of an offence against this Act shall be liable to a penalty not exceeding five pounds for a first offence and not exceeding fifty pounds for any subsequent offence.

45. Onus of proof that any dairy produce was not for sale shall be on the defendant.

46. Where the owner of a dairy farm dairy or factory is charged with an offence against any of the provisions of this Act he shall be entitled to have any other person whom he charges as the actual offender brought before the Court at the hearing of the charge; and if after the commission of the offence has been proved the employer proves to the satisfaction of the Court—

(*a*) That he had used due diligence to enforce the execution of this Act; and

(*b*) that the said other person had committed the offence in question without his knowledge, consent or connivance the said other person shall be summarily convicted of such offence and the said owner shall be exempt from any penalty. The person so convicted shall in the discretion of the Court be also liable to pay and costs incidental to the proceedings.

Where it is made to appear to the satisfaction of the inspector supervisor or other officer or any member of the police force at the time of discovering an offence—

(*a*) that the owner has used all due diligence to enforce the execution of this Act; and

(*b*) by what person the offence has been committed; and

(*c*) that it has been committed without the knowledge consent or connivance of the said owner and in contravention of his orders—

the said inspector supervisor or officer or member of the police force shall proceed against the person whom he believed to be the actual offender without first proceeding against the said owner.

POULTRY HINTS FOR SUMMER.

H. V. Hawkins, Poultry Expert and Lecturer.

Probably there is no more trying time for poultry than the present, especially so when the thermometer reaches 100 degrees in the shade. It must be apparent to all intelligent farmers that live stock must have shade, and none more so than poultry. In my travels through the Goulburn Valley last month, I have been struck with the way birds are penned. They have simply a wire fence 6 feet high, and a house for shelter. This can, and should, be easily remedied.

SHADE AN ABSOLUTE NECESSITY.

While young shelter trees (tree lucerne) are growing, it is a good plan to cut a few branches from trees, and make what may be termed a rough mia-mia in the centre of the yard. When the leaves have dried and

fallen, run over the top of the branches a piece of common hessian, and tie it in at least a dozen places. This will afford a ready shade during the hot weather. The mistake many make is in permitting their birds to shelter in the poultry house. The less they are there the better, otherwise vermin will largely increase, and it will be difficult to cope with the pest. By constantly scratching up the floor for dusting, they ruin the floor of the house. As a matter of fact, fowls dislike remaining in their night quarters during the day, if other shade is obtainable. The want of shade during the hot weather, is the cause of many deaths. The temperature of a fowl's body is much greater than that of the poultry farmer himself. It should, therefore, appeal to him more often than it does. They, who are fond of poultry, are the only successful raisers, nothing being too much trouble when the necessity arises.

Heat Apoplexy.

Primary Causes.—I was informed at Katamatite lately that many hundreds of birds died during the spell of hot weather last summer. The yards which suffered most lacked the necessary shade, and death was due to heat apoplexy. The birds were attacked with a sudden fit of giddiness, and after running round, fell backwards with head twisted.

Prevention.—When the heat is 90 degrees Fahr. in shade and upwards, keep the water cool by placing receptacle in shady spot, changing three times daily, and add a packet of Epsom salts once a week to a gallon of water.

Summer Feeding.

Feed only on soft, easily-digested food, and vary same. Instead of two parts pollard and one part bran each day, alternate to one part pea-meal (rich in sulphur), with one part barley-meal, and a small portion only of bran. Pea-meal by itself is too opening, and is an absolute danger; but, with a corrective such as barley-meal (binding), it makes a splendid change, and does the fowls a deal of good.

Vegetables and Lucerne are most important at this time. Twenty to 25 per cent. of the food should consist of either cabbage, lettuce, onion tops, or lucerne chaffed and mixed with meal.

Avoid the Use of Much Grain.—Avoid maize entirely, it being by far too heating as well as fattening. Animal food also must be reduced. It will never pay to force the hen to lay many eggs at this period. It is as well to reduce their condition prior to the moult, when they will require more food, and that rich in albuminoids. They are, in rather poor condition, better able to go into the moult, when the added daily ration is necessary for the new feather. They will then gradually gain in condition. It must be always remembered that fat hens are poor layers, and what eggs they do lay are very often infertile, the few chicks hatched being poor and difficult of rearing. In feeding the mash (crumbly) to, say, 50 birds, add a half cup of sulphur once a week. This will purify and keep the blood cool. There will then need be little fear of heat apoplexy.

Condiments of all kinds should, on no account, form any part of the ration. Most spices are largely cayenne, salt, &c., which create a thirst. The result is they are scoured. Very many fowls die of this complaint.

TONIC IN WATER.

Put 2 ozs. of sulphate of iron and 85 to 90 drops sulphuric acid (drop carefully) in a small bucket of water. Stir well, and give without further diluting.

DUST BATH.

The need of a cool dust bath is of great importance. Therefore, keep the dust box shaded and constantly damp. Don't be afraid to use the sprinkler, or water can. During last summer this was carried out in my own pens regularly. The birds could be seen lying breast down, with their wings spread out, and they were not in the least affected by the heat, which, for days, ran over the century in the shade. The additional trouble was more than compensated for by the healthy nature of the birds.

VERMIN UNDER PERCHES.

Remove perches once a week, and paint with kerosene, or pour scalding water over them. Syringe well the house with a strong solution of Little's Phenyle, one part to fifty soap suds. A little kerosene may be added to same.

VALUABLE STUD STOCK.

These should, at this time of the year, receive special attention. Purchase a tin of Insectibane, and, with a rubber spray pump, blow it in close to the skin. This will rid the birds of the fowl flea, which is a great drain on them.

Male birds should now be kept by themselves away from the hens, until the breeding season commences in June next, when, providing they are not too old, they should again be mated with the hens you wish to breed from.

Allow the hens a fair amount of liberty. It will better enable them to throw off any surplus fat, and will also start them to moult earlier than would be the case if penned up. As the eggs are infertile, they keep twice the length of time that the fertile ones do.

PORTABLE PENS.

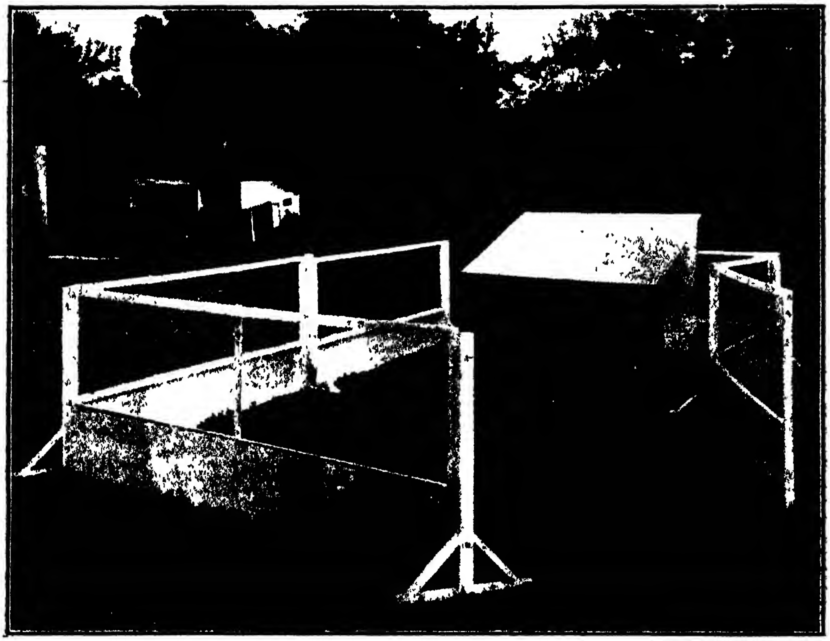
H. V. Hawkins, Poultry Expert and Lecturer.

Portable pens, as exhibited by the Department of Agriculture, at the recent Royal Agricultural Show, under my supervision, should be more often adopted. After the farmers have finished cropping, there is always abundance of insect life and fallen grain on the land, and with a few portable runs, with or without wheels, large numbers of birds may from time to time be kept moving, scratching, and manuring at the same time, feeding themselves at the small cost of labour that it entails, also bringing in a fair return.

When I think of the numberless corn-fields in this State, and of the many thousand tons of grain that were shed in those fields at harvest

time, and a few months later buried below the surface by the farmer's plough, I consider how many tons of poultry could have been raised on this corn in the past twenty years.

The more new ground fowls can run on the more they scratch for insect life, and most certainly will they assist in ridding the land of wild oats and many troublesome insect pests, which often cause serious loss to the farmers. The illustrations show clearly how to construct houses and movable pens. There is really no necessity to make them 6 feet high, 4 feet will answer, providing light frames are placed across the top;



PORTABLE POULTRY PEN.

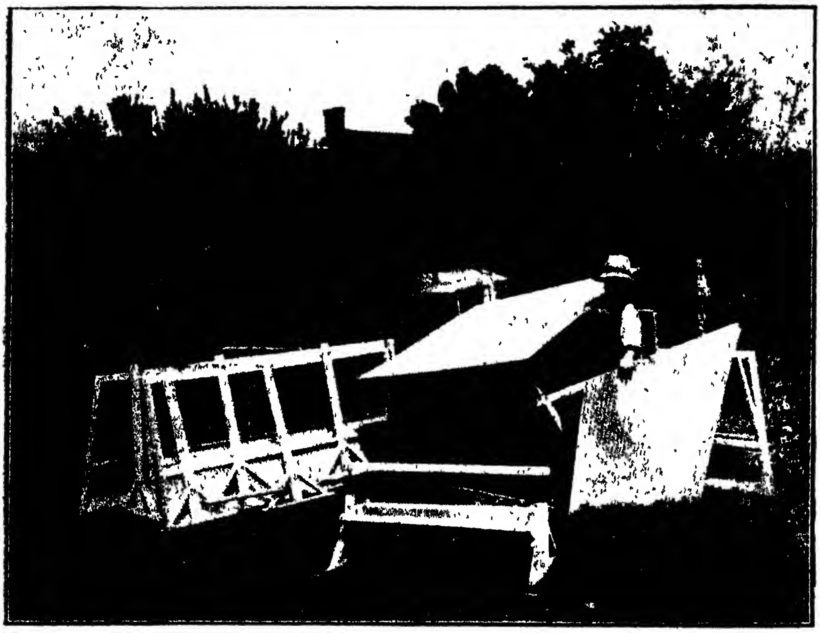
1½-in. mesh is sufficient to prevent the birds flying out or foxes and the like getting in. The size of these runs does not require to be larger than 24 x 16 feet for twenty birds, providing always they are moved at least once a day; twenty birds kept in such pens will turn over practically every sod, and add fertilizer at the same time. The accompanying plate demonstrates the ease by which the house and hurdles may be taken to pieces. The perch is also portable, and is shown in the foreground, with dropping board, which is 18 inches wide, and is suspended by hooks immediately under perch.

Scattered Field System.

Another good plan is to build portable houses, with strong wire doors, sufficient to accommodate twenty adult birds. When the chicks are old enough to leave the brooder-house, or prior to their leaving the mother hen, place a brood in the field-house, confining them there for a few days to accustom them to their new quarters, and feed twice daily until giving them their freedom. Then, each morning, they should be let out and fed

very sparingly; they will get to know you, and answer your call, after which they will find their own food during the rest of the day.

Mr. Grant, of Pakenham, has adopted this plan with great success. Scattered all over his large orchard may be seen neat white houses, all of the same design, and in each a small flock. Strange as it may seem, few birds venture to leave their own quarters. Mr. Grant informed me that no less than 600 youngsters were reared in this way. The ground is kept scarified all the year, and the birds delight to follow the machine, picking up insects, which are so destructive to fruit trees. The fowls keep down the codlin-moth, and, to use the owner's words, "The orchard feeds the fowls, and the fowls feed the orchard."



PORTABLE POULTRY PEN, SHOWING SECTIONS.

Wheat-growers of the north, with a little outlay, could keep 1,000 birds at small cost. When harvesting operations are over, tons of grain are lost, and insects abound, which the birds could secure and thrive on. In England and America many farmers have adopted this scattered-field system, and make £100 to £250 a year from their poultry. All that is required is an enthusiast to take charge, and this, to my mind, is the key to success. It is useless to pay a man to look after fowls if he dislikes them. They require an intelligent and thoughtful caretaker. Northern farmers have grand opportunities to add to their incomes, for if crops are at times partial failures, the fowls will always augment their turnover. There is no finer climate in the world for poultry raising than this. When will the farmers realize it? Are they too well off, or do they lack enterprise? In conclusion, let me urge them to go in largely for Leghorns, 500 of which, by careful selection and breeding, bring in a profit of over £150 per annum for eggs alone. In some parts of the Mallee, this has been, and is still being, accomplished.

DISEASES OF FARM ANIMALS.

S. S. Cameron, M.R.C.V.S.

I.—HEALTH AND DISEASE.

STANDARD OF HEALTH.

It is by no means an easy matter to define the difference between health and disease. Broadly speaking, it is impossible to indicate the dividing line, and say "On this side lies the normal, and on that the abnormal"; for it is scientifically true that what may be a normal condition, or condition of health, under certain circumstances becomes a condition of disease under other circumstances, and, further, it is true that disease may be a normal condition under the circumstances prevailing. What may be normal under some conditions and at some times, will under other conditions and at other times, or if maintained for an inordinate length of time, constitute disease. For instance, if a horse gallops a few furlongs at high speed, his breathing becomes rapid and his pulse increased in frequency for a time. Both these conditions are the natural and physiological result of the exercise. Without the prior exercise, however, rapid breathing and frequent pulse would be abnormal, and would be indicative of some, perhaps, serious condition amounting to disease. Again, when a horse, not in good condition or high muscular training, is smartly galloped a longer distance, his urine shortly afterwards is found to be thick and high-colored, and to contain an excess of a substance called urea. This state of the urine after unusual exercise is perfectly normal, but if it continued for any length of time, or if it existed apart from the unwonted exercise, then it would be a result of disease. On the other hand, and keeping to the same illustration, the breathing, pulse, or proportion of solids in the urine may be decreased to a normal minimum as is the case during sleep; but if that decrease to a low level remains constant, then a condition of disease exists. So that it may be accepted as an axiom that "the maintenance or continuance of a physiological or normal maximum or minimum constitutes a condition of disease." In other words, to constitute disease the modification of function must not be merely a passing alteration, but must be continuous.

So far, the references have been to illustrations of functional changes constituting disease. The same holds good of diseases due to changes of structure, a growth of tissue which, under some conditions, would be essentially natural and advantageous, may, under other conditions, be morbid and injurious. A simple example may serve to illustrate what is meant. Excessive growth of horny cuticle on a blacksmith's palm is not pathological, but is protective and advantageous, and is a natural result of the conditions to which the surface tissue of the skin has been subject; whereas, a similar excessive growth of cuticle taking the form of a corn or wart or epithelial tumour, is essentially a disease product. As another example may be taken the enlargement and engorgement with blood of a cow's udder, which, when occurring about the time of calving, is perfectly natural, but which, if it persisted, or if it existed in a heifer or dry cow, would constitute disease.

The pendulum of health, then, may be said to swing within certain limits, the conditions of life between which limits constitute a *standard of health.* Any stretching of the functions, or any variation of the structure, of any part of the body beyond such limits, constitutes *disease,* which has been defined as "a deviation from the standard of health in any of the functions or component materials of the body."

SYMPTOMS AND DIAGNOSIS.

When a deviation from the standard of health results in changes which can be observed (shivering, for example), or can be detected by the senses (touch, indicating surface heat or cold), or by adventitious aids (thermometer, showing increase of body temperature), such observed changes are called *symptoms,* or signs of disease. Diseases are differentiated from each other, or *diagnosed,* by reason of the fact that different diseases present groups of symptoms, some of which differ from those presented in other diseases. Symptoms which are definitely characteristic of a certain disease are termed *diagnostic symptoms,* as distinguished from symptoms which may be common to two or more diseases. For example, in pneumonia and pleurisy many of the symptoms exhibited are common to both diseases, and to other diseases as well; but the fact that in the former the patient seldom or never lies down, while in the latter he frequently, in the earlier stages, lies down, rolls, and exhibits pain, and the further fact that the breathing in pneumonia, although increased, is less labored and distressed than the short, tifting, painful, and abdominal breathing of pleurisy—these would serve to distinguish between the two diseases, and enable a diagnosis to be made. *Prognostic symptoms* are those by which the probable result of disease may be determined. During the progress of a dropsical disease, for instance, if a mild diarrhœa sets in it is indicative of the commencing absorption and elimination of the fluid; and is interpreted as a "good sign"—one by which recovery may be forecasted or *prognosed.* Similarly, a sudden and marked fall of temperature, following on a condition of high fever, is a symptom prognostic of impending collapse and death.

Symptoms are *general* or *local,* according as their manifestation affects the system as a whole, or is confined to a special part. Shivering fits, rise of internal temperature, and the all-round stiffness of gait in acute rheumatism are general symptoms, while the swelling of a hind limb in lymphangitis, the abscess formation in strangles, and lameness (usually) are examples of local symptoms.

It is advantageous to understand a further classification of symptoms into premonitory, primary, and secondary. *Premonitory symptoms* are those which precede the full development of a disease, and they may be common to different diseases. Increase of pulse, temperature, and respiration are premonitory symptoms of many diseases. They usually indicate disease of an inflammatory character, but, of themselves, they throw no light on the actual seat of the inflammation. Symptoms which arise directly as a result of disease, as, for example, the pain and swelling observable as the result of a bruise, are called *primary symptoms,* while the lameness which might ultimately follow as a result of the swelling, or the symptoms of blood poisoning which might arise from the absorption of septic matter from the bruise, would be *secondary symptoms;* that is, they would depend, not directly on the original bruise, but on a further development of conditions resulting from the primary effect of the bruise.

Where animals are concerned, the recognition and interpretation of symptoms of disease present many difficulties with which the practitioner of human medicine is not faced, and entail an almost entire dependence on the observational faculties of the veterinary student. The existence of pain, for instance, can only be known by observation of the attitude, expression, and action of the dumb patient, and the seat of pain by the evidences of the avoidance of movement of the affected part. Such evidences are frequently of the slightest, and require extraordinary care, quickness of observation, concentration of thought, and sound reasoning for their perception. There is, however, with animals the compensatory advantage that the evidences are mostly honest, and afford data from which reliable inferences can be drawn. In the manifestation of disease, animals are incapable of lying to their attendants, even though at times amongst horses a cunning old stager is met with who will " gammon lame " on occasion in a manner which cannot but compel admiration of his histrionic ability.

CHARACTERISTICS OF HEALTH.

In the differentiation of symptoms which is necessary for the diagnosis of disease in animals, the exercise of the faculty of observation will be found of little value without a correspondingly good knowledge of the signs of health and acquaintance with the habits of animals under natural conditions. Especially is the latter necessary in field investigation of disease, in the inspection of mobs of cattle for contagious disease, and in the examination of half-wild, unbroken, or unmanageable beasts, when the use of such implements of trade as the stethoscope, thermometer, and opthalmoscope is out of the question.

Although, by constant association with animals, most stockmen acquire an instinctive comprehension of the normal or healthy features of the domestic animals, to the tyro and student the subjoined signs and habits of health in cattle prove useful. (The signs and habits of health in horses were given in an article by the author on " Health Factors in Horse Management." See *Journal* for December, 1905.)

Signs and Habits of Health in Cattle.

ATTITUDE.—*Stands* firmly, with weight equally disposed on all four limbs. A cow in health never " stands at ease " or knuckles at the fetlock either before or behind. Generally engaged in either feeding or ruminating (chewing the cud). *Rests* by lying down with weight on the breast bone in a half-upright position; never lies flat on side. *Rises* hindquarters first; usually stretches on rising.

APPETITE.—As in horse.

CHEWING THE CUD (Rumination).—Performed deliberately and lazily, with head protruded. When the bolus of food is regurgitated into the mouth, it is placed between the teeth and the cheek on one side by one movement of the jaws and tongue towards that side. The subsequent " cuts " or movements of the jaws until the bolus is swallowed are all in the opposite direction, and usually number about 40.

COAT.—Greasy to the touch; glossy, sleek, and flat in summer, full and somewhat rough and long in winter; easily shed when rubbed during approach of spring; " lick marks " on back, loins, ribs, quarters, and thighs indicate thriving condition and contentment.

SKIN.—Supple and loose; moderately scurfy; white, not pigmented, in most breeds.

EARS.—Mobile and powerful.

EYES.—As in horse, but larger and more prominent.

MUZZLE AND NOSTRILS.—Moist and cold; dotted over with distinct drops of moisture or "dew."

TEETH.—Incisors loose in lower jaw, molars with level grinding surfaces; free from points and jags.

VISIBLE MUCUS MEMBRANES.—As in horse.

HOOFS.—Smooth and polished, free from rings, cracks, or unevenness of growth.

UDDER.—Quarters even (bilateral symmetry); uniformly soft to the touch, and flow of milk easy and uniform from each teat.

DEJECTA (Dung).—*Quantity:* From 75 to 85 lbs. in the twenty-four hours. *Appearance:* Soft and pultaceous except when on hard feed, when they may be "formed," and somewhat dry and coherent; colour varying with colour of food. Cattle seldom masticate or digest whole grains of cereals, and when these are contained in the food they usually appear unaltered in the dung, except for being swollen and slighted bleached.

URINE.—*Quantity:* Average 20 to 22 lbs. daily, a good quantity (about 3 quarts) voided at a time. *Appearance:* Pale sherry colour, without fœtid odour or excess of sediment, slime, or blood tinge. Specific gravity, 1030 to 1040.

TEMPERATURE.—*Internal:* At vagina, varies from 100 degrees F. to 102 degrees F.; average, 101.5, and should not exceed 102.5. *External:* Equable warmth of ears, horns, skin, and extremities.

PULSE.—Frequency of the pulse is very variable and unreliable. From 35 to 80 per minute; average, 45. A healthy pulse should be full and soft to the touch.

BREATHING.—Should be both abdominal and thoracic, and number eight to twelve beats per minute. In some diseases the breathing may be wholly abdominal or wholly thoracic.

RAPE CROPS AT DOOKIE.

H. Pye, Principal, Dookie Agricultural College.

Every day the very important question of producing winter fodder for stock is becoming more essential for economical farming. There is little doubt that a thorough grasp of the question by farmers in general will make it possible to produce a wider range of products, and thus enhance the value of the smaller farms. There seems to be a limited number of plants suitable for winter fodder for stock in the northern parts of Victoria, but the cereals, if put in early and grazed, are perhaps more hardy and suitable than any of the imported grasses. Towards spring the harrows can be put over the field, after the sheep or cattle have been taken out, and the crop allowed to come away for grain or hay.

PLANTS RELATED TO RAPE.

Belonging to the same botanical family as rape are cabbages of all kinds, kale and kohl rabi. A farmer, having a small paddock of rich land, can, if the season permits, grow an enormous crop of cabbages. In some places it is a general practice to grow field cabbages for milch cows, but they must not be grown out of season, as they will flavour the milk. Heavily manured crops of these cabbages give yields of over 60 tons to the acre, but at Dookie the best crop on a small area was not one-third of such yields. The early Drumhead, and in the main early varieties, suit the climate better than late varieties. However, by utilizing different varieties, a succession of fodder may be obtained that will last well into the spring.

DRUMHEAD CABBAGE, WEIGHING 25 LBS.

Kohl rabi is sometimes called the turnip-rooted cabbage. It has not been grown much in Victoria. With us it has not been as successful as rape and kale.

The Thousand-headed Kale is no doubt a very fine fodder plant. It has been grown here at different times for the last eighteen years, but not on a wide scale, as rape seed was much cheaper, and the labour attached to the growing of it less. The seed is rarely sown broadcast, but in drills, the plants being singled out to give them space. The land is kept cultivated between the rows. Exceedingly heavy crops, grown under favorable conditions, are superior to rape. It lasts much longer into the spring before running to seed, and is perhaps better relished by sheep. Kale, cabbages, and kohl rabi are frequently transplanted out from early plants grown in seed beds. A pound of seed, under such conditions, would be sufficient for an acre, if planted out in rows, 30 inches apart or thereabouts, and up to 2 feet between the plants. The cost of putting in the crop is increased by this method, hence it is cheaper to sow by the drilling machine, and use more seed. However, when the autumn is dry, a seed bed may be kept watered, and the plants given a good start if planted out as soon as the rain does come.

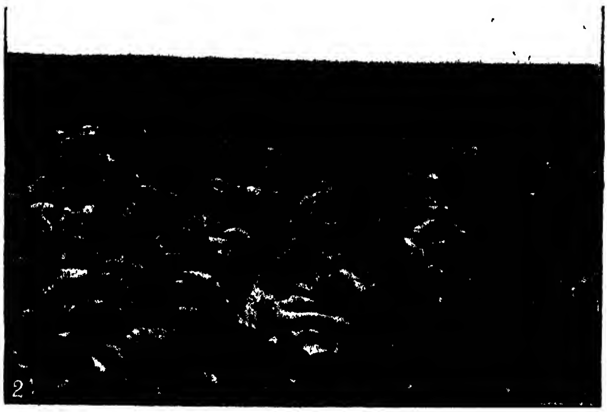
Cultivation of Rape.

This crop has scarcely had a fair trial in most of the northern districts. It has been tried at Dookie College for many years, and during the last decade or more, some magnificent crops have been grown, and some very poor ones.

The variety grown for fodder production is commonly called the Broad-leaved Essex. It is the best of seventeen varieties tried at the College, owing to the abundance of succulent foliage it produces when grown under suitable conditions. The seed is dark, the immature seed being reddish. There are varieties of Indian rape that have yellow seed, but the Indian varieties are grown for their oil-producing seeds. The oil extracted from rape seed is commonly known as colza oil. For this purpose it is not grown in Victoria, but simply as a forage plant.

PREPARATION OF THE SOIL.

Soil for rape should be deep, and as rich as possible. The land should be well ploughed, and as deep as the nature of the soil will



CABBAGE PLOT (40 TONS PER ACRE).

permit, as the plant is deep-rooted. The soil should be well worked until a fine tilth is obtained, or as fine a tilth as the nature of the soil will allow without "running" when the weather is wet. The more even and firm the seed bed the more regular will be the germination, and the better the crop.

SUITABLE SOILS AND FERTILIZERS.

Rape is a greedy feeder, and naturally it follows that the soil selected for growing a good crop should be rich in available plant food. Under such conditions returns of between twenty and thirty tons per acre of fodder are not uncommon, provided the season be favorable. It is seldom that on the generality of farms the land is naturally very rich, hence to get the best returns fertilizers should be applied. It likes a soil in which there is plenty of humus or organic matter, and for most soils, farmyard manure gives the most satisfactory returns, especially when supplemented with a dressing of superphosphate. In the northern parts of Victoria farmyard manure is not made in sufficient quantities,

hence commercial fertilizers are more commonly used for enriching the soil. Light sandy soils do not suit rape, but any nice loam, the deeper the better, will grow a crop of it. Good strong soils suit it, but heavy clays are not so good. In most instances, rape seems to be grown as a catch crop, and there is no doubt that after a barley or other cereal crop, if the land be disced and sown with rape, a nice serviceable crop of mixed fodder is frequently obtained, provided the rains fall early in the autumn. There is, however, more success in a properly-prepared field.

From the results of the experiments carried out during 1905, the crop of rape fertilized with the complete manure, that is, one containing superphosphate, sulphate of ammonia, and either potash chloride or potash sulphate, was the best, followed by those plots treated with superphosphate alone. The individual plots fertilized with the nitrogenous and potassic fertilizers respectively, were not much better than the unmanured plots that were not cultivated, but where all plots were cultivated the crop was more responsive. The difference between the manured plots, when harrowed, and the unmanured plots, also harrowed, was considerably greater, to the advantage of the manured plots. It was clearly demonstrated that not only did the harrowing improve the unmanured crop, but it encouraged the fertilizers applied to give proportionately much better results than if the land was not harrowed. The field of rape referred to above was well ploughed and worked. It was then sown down with rape, the grass-seed sower of an ordinary grain drill being used for the purpose. The plots ran the whole length of the field. The light harrows were passed over half the field when the plants were about three or four inches high, crossing the plots at right angles. A good many plants were pulled out, but there were sufficient left. The season was not a good one for rape, and there was relatively not much difference between the manured and the unmanured crops, except the halves that were harrowed. The cultivation enhanced the value of the fertilizers considerably. The limed plot gave a fairly good return, for, owing to the wet winter, the soil had become water-logged and sour.

The Advantages of Fallowing.

The crop of rape on the fallowed land showed the most pronounced results. The unmanured plots were better, or as good as the best of the plots on the unfallowed land; but where the fallowed land was manured, the crop was much better than similarly treated land unmanured. It seems, from these and past experiments, that in order to get the best results in the drier parts of the State, and to have the rape ready in winter, when it is most needed, more effort should be made to force the growth. This can be done by fallowing a piece of the land, manuring it well, and sowing the seed as early as possible, say about March, or the beginning of April. When the crop is not ready until spring, in most instances the object in growing it has not been attained, as there is an abundance of grass usually available. On the other hand, very great benefits are derived from it when the rape crop is ready for May, June, July, or August. It produces a fine flow of milk in ewes and cows, and is remarkably fattening. Though cows are not usually pastured on rape, still they may be as long as judgment is used. Even the calves appeared to thrive on it, though they were not on it all day, whilst the horses had a free run on it at times, and seemed to like it.

THE RATE OF SEEDING.

From the results of the experiments where the seed was sown by the drill and allowed to fall broadcast, the spouts being taken off, 4 lbs. of seed to the acre was ample. Above that amount the plants were too thick. Three pounds of seed to the acre was almost enough on plots where the harrows were not subsequently used, but where they were, the seeding was too thin. The seed was good, and germinated well. When sown up to 6 lbs. to the acre, the plants were much too close, and grew spindly. If the seeds be sown in drills 30 inches apart, of course it will take comparatively little seed, viz., from 1½ to 2 lbs. per acre. If too thick, a light harrowing across the drills will thin out the plants, and give a cheap cultivation also. Any cultivations between the drills would keep the land free from weeds, and stimulate the growth of the crop. When sown thinly, the plants are larger and coarser, and perhaps the medium-sized plants, due to a thicker seeding, are relished better by sheep, which first eat the sweet central shoots.

Mustard seed is frequently sown with rape. It is earlier to germinate and to mature than the latter, and has a stimulating effect on the sheep's stomachs. From ½ to 1 lb. of mustard seed to the acre is sufficient to mix with the rape seed. The yellow seeds of the white mustard assist in determining where the seed is sown, when using a Cahoun broadcast sower.

WHEN TO GROW RAPE FOR FODDER.

Undoubtedly the best time to grow rape in the Northern districts is in the early autumn. The seed should be sown ready for the first good rains of the new year. These sometimes fall during February, but not often. Spring-sown rape is an uncertain crop in the northern parts of the State, though it may be grown with success in the moister districts during the early part of spring. Sometimes a rape crop, sown in spring, in the dry districts, struggles through the summer, and comes away well in March, but the aphis is too troublesome, and attacks it then. When the land is very rich, sometimes a good spring-grown rape crop is seen, but towards the end of November, unless the season be exceptionally favorable, there is a great loss of palatableness, and the sulphur oils give a strong flavour to the mutton and milk respectively from the sheep and cows fed on it. Rape is not a summer crop, and, like most unseasonable crops, is not satisfactory when grown late.

HILLSIDES FOR RAPE-GROWING.

Hillsides sloping towards the east and north-east have proved to be very good aspects for the growing of rape on the College farm. The soil, though of medium to poor quality, is well drained, warm, and not so subject to frosts as the lower and richer lands. On most occasions the rape grown on the hillsides has been much earlier, and much better than that grown on the flats. On the hill it grew in winter, and kept growing, and on one occasion, when the seed was sown a month later than on the flat, the crop readily overtook the latter. Rape will not thrive where the drainage is bad. There it quickly assumes a reddish tinge, especially during frosty weather. On the poor hillsides it is necessary to give a good dressing of manure. If you want the crop early it must be forced, and 2 cwts. of superphosphate to the acre are not too much. If a dressing of farm-yard manure be also applied, the results

are much better; failing that, potassic and nitrogenous fertilizers are beneficial in conjunction with the superphosphate, but individually the application of these have not been satisfactory here. For a general cleaning crop, 2 to 3 cwts. of fertilizer per acre are very seldom used in Victoria, dressings from ½ to 1 cwt. being more general, if a fertilizer be used at all. Under such circumstances a fresh field is advisable each year rape is sown, since rape does not respond so well when grown frequently in the same field, or at short intervals between each crop. The best results are almost invariably obtained from the plots with the heaviest dressings of fertilizers, provided the soil is properly worked, and the drainage is suitable. One great advantage of growing rape on well-drained slopes is, that the sheep may be put on it at almost any time, whereas the land may be too wet on the flats.

Rape for Fodder.

The sheep turned on the experimental area ate the rape growing on the fallowed land first, including that on both the manured and unmanured plots. Then the harrowed portions of the plot were given attention to, the sweet central parts of the plants being eaten first. The plants tinged with red from poor growth remained untouched as long as any of the better-grown plants were available. The plants with the

RAPE, 18½ TONS PER ACRE.

reddish-tinged outer leaves were general over the parts not harrowed, both in the plots manured and unmanured. There were fewer of them on the plots to which a complete manure was applied. The palatability of rape depends mostly on the rate of growth, and this latter depends on the climatic conditions, the mechanical condition of the soil due to cultivation, and its fertility. Rape, for fodder purposes, is not so palatable when grown during warm weather with dry spells. It is then tough and rank tasted, but if grown rapidly when the temperature is lower, the plants are sweet and succulent, and otherwise appetizing. Under these

conditions it may be fed to milch cows. This season the milch cows at the College were pastured for a time on rape without tainting the butter, for which top prices in the open market were received, equal to those obtained for the best Western District brands. The rape grown on the plots fertilized with a complete manure was better coloured, and, according to my judgment, better flavoured than that grown in the other plots, except where the ground was fallowed. The fallowed ground produced the mildest flavour. Sheep appear to have a good deal of discrimination, and it was noticeable that in one small paddock they would leave certain small patches until forced to eat it. These patches were those where some fresh farm-yard manure was applied. Towards the end of spring, and the beginning of summer, rape sown in the autumn has a stronger flavour, and this is very marked in mutton from sheep fed on it. There is a field for interesting experiment open to plant breeders in developing the fattening and flesh-forming qualities of rape and other fodder plants, just as sugar-beet and sorghum growers, with the aid of the chemist, have developed the sugar-producing qualities of these plants, making it, especially in regard to sugar-beet, possible to grow this crop on a large commercial scale for the production of sugar in countries where sugar cane will not succeed.

RAPE FOR POULTRY AND PIGS.

Rape is one of the best plants for sweetening the poultry run. If the run be ploughed, or dug up during autumn, and the soil well worked, a very fine lot of rape may be grown, especially with the aid of an application of superphosphate along with the poultry manure already in the soil. Rape seems to invariably do well under such conditions, and the poultry manure, being rich in plant food, is just what the rape needs to give good returns. In spring, the chickens and fowls revel in it, and thrive. The exercise the chickens receive jumping for the top leaves helps to keep them healthy.

Perhaps no crop that can be cheaply grown near the piggeries is as useful as rape. It is a healthy fattening food, and may be fed to the pigs, or they may be allowed to graze on it. It has been grown at the College for the purpose for the last eighteen years, sometimes alone, and sometimes in conjunction with barley.

OTHER USES OF RAPE.

Rape is an excellent crop for green manuring, when a soil is deficient in organic matter, but in the Northern districts very little direct green manuring is done, but by eating down the rape with sheep the soil is much enriched for any succeeding crop. Immediately the rape is eaten down at the end of the season, the land may be ploughed, and may again be sown with a summer crop, such as amber cane, maize, or millet, and again eaten down by stock, thus adding more organic and fertilizing matter to the soil. A good deal depends on the time the summer rains come whether the amber cane will be ready to be eaten off before April. If the land is needed for cropping, it should be ploughed and sown down before the middle of May.

Rape is not a good crop for the silo. Rape silage has been made here on several occasions. It preserves well, but the resulting food is too pungent, smelling of the sulphurous oils present in it, and flavours too strongly meat or milk from animals fed on it.

Rape is seldom grown in this State for seed purposes. It may be grown much cheaper in other places, as an oil-producing plant. In such places the plants are cut and bundled before the pods burst, allowed to dry in the open, and then threshed. Here the seed is sometimes stripped with the wheat stripper slightly modified. There is, however, a good deal of waste.

Some Results of Experiments in Victoria and Elsewhere.

Hungry animals should not be turned on to a rape crop, otherwise hoven or bloat will occur amongst them, more especially if the rape is wet.

It is advisable not to grow rape on the same field frequently. It does not appear, as a rule, to succeed as well as when sown down with it at intervals of several years.

When a field has been manured with rank manures, especially those rich in nitrogen, rape is an excellent crop. Any of the cereals grow too rank, and are liable to be lodged or caught by the hot winds of November. The lengthening of the growing period before running to seed is, in the case of rape, an advantage, while in our climate it is bad for the grain crops.

Rape supplies much organic matter to the soil by means of the decay of its roots alone. This plant has a good root system, as may be expected from its rapid growth and supply of fattening foliage. If the season is favorable it is ready to graze in less than three months. White mustard is ready a month earlier.

If rape is not cut too close to the ground, or is not fed down too severely, a second and third crop may be obtained. Last year the rape on one small paddock with an eastern slope, was cut early in the season, and since then it has been fed off three times by sheep.

COST PER TON OF GROWING AN ACRE OF RAPE. YIELD 8 TONS PER ACRE.

	Farm Labour.		Contract.		
	s.	*d.*	£	*s.*	*d.*
To rent of 1 acre, 7s.; rates and taxes, 6d. ...	7	6	0	7	6
,, Ploughing, horse feed, labour, interest, &c.	3	6	0	5	6
,, 2 harrowings (discing, if needed, 1s. and 1s. 8d. extra)	0	10	0	1	6
,, Sowing seed and fertilizer	1	4	0	2	6
,, Rolling or light harrowing	0	5	0	0	9
,, 1 cwt. of superphosphate	5	0	0	5	0
,, 4 to 5 lbs. of seed	1	3	0	1	3
Cost per acre	19	10	1	4	0
Cost per ton of fodder ...	2	5¾	0	3	0

The cost of putting in one acre of rape on fallow land would amount to at least 50 per cent. more for rent, the land being idle longer. Then there would be two cultivations of the fallow with the spring tooth harrows (1s. 4d. and 2s. for farm and contract work respectively). The extra cost is compensated by the increased yield, and the supply of fodder being available when most needed. The resulting credit returns of a

crop of rape, due to the fertilizing of the soil, cleaning of the field by feeding down with sheep, also the increased value of the sheep as fats, make a well-grown crop very profitable.

NUMBER OF SHEEP TO THE ACRE.

It is evident that the number of sheep to the acre that a rape crop will carry depends on several conditions, but the two principal ones are the earliness of the crop and its weight per acre. The latter is due to the season and soil being suitable and well-drained. The earliness of the crop extends the time of feeding, and this is an advantage with farmers' flocks, as they are not generally large, and the crop is well eaten down by the beginning of summer. Several growths are obtained, provided the plants are not eaten out at first, and in this way a heavy bulk of fodder is produced and utilized when most needed. Fewer sheep to the acre for a longer period will be carried, and consequently there is less trampling, with freshening intervals. When the crop is allowed to reach its full growth before seeding, it sometimes happens that it grows faster than the sheep can eat it, especially if there be a limited number to feed it off. When the crop is well above the surface, the effects of the excreta from the sheep are not so objectionable. and more sheep to the acre may be put on without fouling so much of the fodder, for the sheep undoubtedly use much discrimination. It is advisable to occasionally take the sheep off for a week or more, according to the needs of the crop. During some seasons there have been occasional crops at the College that would carry from ten to fifteen sheep to the acre for four months, and on one or two occasions it has rushed to seed, the plants, when in flower, being over the heads of horses that were also grazing on the crop. Where a crop goes to seed there is more labour involved in ploughing the field, and there is an exhaustive effect on the soil. The average crop of rape, however, in this district will not carry more than four sheep to the acre for three to four months. It must be remembered in these cases that the field is not heavily manured, and the cleansing effect of the crop is a great additional advantage.

AGRICULTURAL EDUCATION.

Report on Classes held during 1905.

F. E. Lee, Agricultural Superintendent.

This past year has seen such a great expansion in the work of the Agricultural Classes, that some slight review of the whole scheme may not be out of place. Inaugurated in 1902, by Mr. S. Williamson Wallace, late Director of Agriculture, to meet an obvious demand on the part of the younger generation of farmers and others interested in agricultural pursuits, the classes were not long in becoming popular among those who attended. The small number of centres selected in the first year, viz., three, was increased to seven in 1904, and to eleven in 1905. It is highly gratifying to those who have charge of this important branch of the general scheme of agricultural education to know that no less than 31 applications were received, distinct evidence not only of their popularity, but a recognition of their educational advantages as well. Had

the Department a staff complete enough to have accepted all the invitations to establish classes, the number would have been greatly enlarged, but when it is remembered that the lecturers attached to the Department have, in addition to their work at the classes, other duties to perform, it is hardly surprising that the number of centres was limited to those which could be accomplished within a given time.

It may not be out of place to remark that the qualities which make a successful lecturer to adults are not necessarily identical with those for a similar duty to students. Lucidity of expression, prominence given to fundamental principles, and above all, simplicity of language are not the least of the requirements necessary to arrest the attention of large gatherings of men of mixed ages, such as one finds daily attending these classes.

The subjoined results of the voluntary examinations are sufficient guarantee that a great proportion of the students benefited materially by the instruction given. What is perhaps more important still—the thoughts of many have been directed into channels, hitherto unknown, the systematic following up of which must inevitably leave its mark on the agricultural progress of each locality where classes have been held.

Agricultural Students Associations.

At the termination of each class, the suggestion was made by the writer that in order to keep up the interest, and make the work continuous, the students, with the assistance of any other persons interested, should form among themselves an association which would have for its object, the formation of a small library of approved text-books on agricultural and kindred topics, which might circulate among the members. A nominal subscription only was suggested in order to facilitate the formation of the associations, the management of which would devolve upon local office-bearers. Some six or eight of these associations have either been formed or are in process of formation, and it is thought that they will be the means, in the future, of spreading useful information and bringing to the front any latent talent in agricultural matters.

Classes held during 1905.

Classes were established at Nhill, Geelong, Stawell, Kaniva, Warracknabeal, Donald, Murchison, Numurkah, Nagambie, Dunolly, and Ballarat, the term of each (with the exception of Nhill), being two weeks.

The lecturers were as follow:—

Dr. Cherry.—Introductory Lecture.
F. E. Lee.—Manures, Cultivation, and Experimental Work.
A. S. Kenyon.—Agricultural Surveying and Water Conservation.
G. H. Adcock.—Agricultural Botany and Diseases of Plants.
R. Crowe.—The Export Trade.
R. T. Archer.—Dairying and Dairy Management.
H. V. Hawkins.—Poultry Management.
D. M. Boyd.—Agricultural Surveying.
M. d'a. Burney.—Viticulture.
H. S. Rudduck.—Veterinary Science.
W. C. Robertson.—Agricultural Chemistry.
W. Haile.—Wool Sorting and Classing.
W. Kenneally.—Practical Farriery.
E. Plumridge.—Wool Sorting and Classing.

The average daily attendance taken as a whole constitutes a record, and with one exception every centre has completely justified its request for the establishment of a class.

The following table gives an analysis of the attendance and results of examination for each centre, the large number of visitors who attended more or less regularly not being included in the return:—

Centre.	Number of Students Enrolled.	Average Daily Attendance.	Number of Examination Papers.	Percentage of Marks Gained by each Centre.
Nhill ...	86	55	127	48.39
Geelong ..	97	53	122	37.78
Stawell ...	87	45	64	45.28
Kaniva ...	122	79	183	32.44
Warracknabeal	66	42	74	31.67
Donald ...	71	37	38	53.90
Murchison ...	112	45	50	40.15
Numurkah ...	186	72	92	29.49
Nagambie ...	116	52	87	35.92
Dunolly ...	98	47	65	55.66
Ballarat ...	33	16	25	51.06

The above figures show that 1,074 students attended the lectures. The total number of examination papers in all subjects was 926, showing the highly creditable average of nearly 50 per cent. of the maximum number of marks obtainable for each student.

EXAMINATION RESULTS.

Examination papers were set by Messrs. Lee, Rudduck, Kenyon, Boyd, Hawkins, Haile, Archer, Adcock, Robertson, and Plumridge. The brief time allowed for examination only permitted of a few comprehensive questions being set by each lecturer. Regarded as a test of how the instruction had been received, the results are highly favorable, and are an indication that the great majority of students possess a good knowledge of the leading features of each subject.

The following are the detailed results for each centre:—

NHILL.

Student's Name.	Lee.	Rudduck.	Adcock.	Hawkins.	Haile.	Robertson.	Total.	Percentage of Maximum
Dahlenberg, H. A.	89	90	90	80	97	84	530	88·3
Hensley, W. A. ...	85	90	85	75	98	90	523	87·1
Pilgrim, P. ...	79	80	80	85	94	92	510	85·0
Bond, J.	65	86	80	45	72	59	407	67·8
Sanders, W. C. ...	70	50	50	65	85	78	398	66·3
Wheaton, C. M. ...	66	56	60	45	65	90	382	63·6
Weir, A. ..	60	40	75	50	72	69	366	61·0
Hoffmann, E. G. ...	68	65	...	50	91	64	338	56·3
Welsh, W. ...	52	60	35	40	58	45	290	48·3
Shanasy, J. ...	53	55	...	55	51	47	261	43·5
Langtry, L.	40	25	40	35	50	44	234	39·0
Meagher, J. ...	29	30	40	20	85	22	226	37·6
Dahlenberg, P. ...	40	32	40	20	62	15	209	34·8

NHILL—*continued.*

Student's Name.	Lee.	Rudduck	Adcock.	Hawkins.	Haile.	Robertson.	Total.	Percentage of Maximum.
Geneil, J. ...	33	30	30	35	64	16	208	34·6
Moulden, S. ...	28	35	...	40	50	30	183	30·5
Peapes, G. ...	30	30	5	20	65	29	179	29·8
Wohlers, A. ...	28	42	30	40	...	...	140	23·3
Steadman, G. ..	38	46	...	55	...	..	139	23·1
Weir, W. ..	24	58	...	20	...	13	115	19·1
Hales, H. ..	50	...	.	35	...	.	85	14·1
Sherwood, Miss ..	68	..	50	90	95	77	380	63·3
Garretty, Miss ..	62	..	65	75	96	73	371	61·8
Shanasy, Miss B. ...	68	...	80	79	..	86	313	52·1
Towns, Mrs. ..	..	...	55	86	..	45	186	31·0
Gladigau, H. ...	..	..	...	..	80	...	..	Non-competitive.
Schmidt, F. .	.	.	...	..	80	..	.	
Batson, J.	..	...	..	..	70		..	
McPherson, L. .	..	...	...	..	58	..	..	

GEELONG.

Student's Name	Lee	Rudduck	Hawkins.	Boyd.	Archer	Plumridge.	Total.	Percentage of Maximum.
Stewart, H L. ..	87	82	100	65	100	85	519	86·5
Farrer, J. F. ...	88	76	100	50	100	90	504	84·0
Fargie, A. J. ..	82	90	100	85	99	40	496	82·6
Grace, F. ...	67	95	100	35	100	85	482	80·3
Anderson, G. ...	50	58	56	65	91	100	420	70·0
Fraser, R. ...	.	82	95	..	99	85	361	60·1
McDonald, D. M....	3	10	88	35	89	50	335	55·8
Cecil, Ash ..	74	45	54	15	90	40	318	53·0
Heard, R. E. ...	...	73	90	20	93	40	316	52·6
Weitnaur, E. ...	..	44	88	35	89	50	306	51·0
Hennessy, J. M. ...	.	60	95	...	99	20	274	45·6
Robb, T. ..	45	25	76	25	94	...	265	44·1
Errey, John	15	55	74	25	91	..	260	43·3
McGuinness, M. W.	70	...	80	...	95	..	245	40·8
Anderson, A. ...	55	..	40	30	92	25	242	40·3
Trebilcock, F. ...	...	45	72	..	92	..	209	34·8
O'Brien, A. ...	52		78	5	72	..	207	34·5
Devlin, C. ...	..	25	80	...	85	15	205	34·3
Sutherland, H. D.	46	43	.	30	.	80	199	33·1
Crossley, O. E. ...	...	..	100	...	94	..	194	32·3
Ritchie, F. D. ...	...	...	100	...	80	..	180	30·0
Jackson, John ...	..	...	80	...	85	..	165	27·5
Spowart, W. G. ...	...	...	70	...	92	.	162	27·0
Smith, G. H. ...	...	..	56	...	92	..	148	24·6
Bowman, C. ...	.	20	40	...	82	.	142	23·6
Jackson, P. ...	...	...	40	...	91	...	131	21·8
Anderson, D. J. ..	31	68	...	10	.	20	129	21·5
Fogarty, P. ...	...	52	...	...	...	55	107	17·8
Howell, J. L. ...	...	...	..	...	..	85	85	14·1
Heyward, G. ...	..	...	..	...	...	85	85	14·1
Lowe, Eric ...	...	...	..	...	...	80	80	13·3
Judd, A. O. ...	...	50	...	..	...	...	50	8·3
Pearson, A. ..	...	...	..	...	..	45	45	7·5
Ham, E. W. ...	...	...	...	...	..	40	40	6·7
Cozens, J. ...	...	...	..	...	..	35	35	5·8

STAWELL.

Student's Name.	Lee.	Rudduck.	Hawkins.	Haile.	Total.	Percentage of Maximum.
McMurtrie, J. A.	75	86	85	85	331	82·7
Whitehead, W. A.	49	78	90	95	312	78·0
Best, C.	50	76	75	80	281	70·2
Reading, A. M.	50	80	55	85	270	67·5
Vance, A.	62	40	65	90	257	64·2
Falls, H.	45	68	60	70	243	60·7
Freeman, W. S.	30	68	65	78	231	57·7
Smith, J. T.	35	50	55	80	220	55·0
Kilpatrick, W. A.	50	71	...	95	216	54·0
Taylor, R. B.	25	...	75	90	190	47·5
Hutchings, J. C.	...	...	90	100	190	47·5
McKay, A.	54	70	50	...	174	43·5
Smith, Jas H.	15	40	55	50	160	40·0
Garnett, W. F.	...	...	52	93	145	36·2
Sinclair, W.	...	...	45	67	112	28·0
Martin, W.	...	25	80	..	105	26·2
May, A.	...	...		100	100	25·0
Pinchard, A.	...	...	..	95	95	23·7
Rathgeber, F.	..	..	75	...	75	18·7
Cato, Mrs.	..	...	100	...	100	25·0
Grieve, Mrs.	...	..	90	...	90	22·5
Cook, Miss E.	...	...	90	..	90	22·5

KANIVA.

Student's Name.	Lee.	Rudduck.	Hawkins.	Haile.	Kenyon.	Total.	Percentage of Maximum.
Rowe, Edwin G.	61	56	90	100	65	362	72·4
McCallum, L. C.	83	78	78	68	55	362	72·4
Schmidt, Andrew	64	80	66	95	50	355	71·0
Crouch, W. J.	58	68	88	60	50	324	64·8
Sanders, C.	70	66	70	60	50	316	63·2
Steer, A. F.	28	63	52	85	30	258	51·6
Goodwin, F.	36	75	70	70	...	251	50·2
Feder, F.	37	48	44	70	50	249	49·8
Moar, S. J.	25	52	72	60	35	244	48·8
Schmidt, F. H.	22	55	68	65	30	240	48·0
Crouch, Albert G.	47	44	48	70	30	239	47·8
King, Fred.	27	58	72	55	25	237	47·5
McCallum, C.	24	55	76	80	..	235	47·0
Webb, Oliver	...	63	70	80	20	233	46·6
Crouch, H.	46	55	68	55	...	224	44·8
Vivian, John	28	58	48	50	35	219	43·2
Nicholls, H.	30	39	70	50	15	204	40·8
Goodwin, P.	...	52	72	76	...	200	40·0
Gale, M.	37	50	44	53	10	194	38·8
Saltmarsh, E.	20	50	48	57	15	190	38·0
Crouch, E. J.	24	45	68	50	...	187	37·4
Lawrance, B. J., sen.	41	66	66	...	...	173	34·6
Vivian, F.	15	46	50	50	10	171	34·2
Holland, J. D.	...	40	50	78	...	168	33·6
Arthur, F. J.	...	45	50	67	...	162	32·4
Vivian, A. W.	20	26	55	60	...	161	32·2
Laxton, F.	...	50	58	50	...	158	31·6
Henstridge, N.	13	20	38	70	15	156	31·2
Sanders, A. E.	...	...	64	90	...	154	30·8
Webb, A.	...	...	76	75	...	151	30·2

KANIVA—*continued.*

Student's Name.	Lee.	Ruddock.	Hawkins.	Haile.	Kenyon.	Total.	Percentage of Maximum.
Goodwin, A. W. ...	...	..	84	67	...	151	30·2
Goodwin, J. A. ..	...	...	74	63	...	137	27·4
Werrett, W. F. ...	16	30	44	45	...	135	27·0
Bond, H. W.	...	...	93	40	...	133	26·6
Henstridge, F. ...	12	36	58	25	...	131	26·2
Lloyd, A. E.	...	63	68	...	...	131	26·2
Arthur, W.	..	10	44	75	...	130	26·0
Gardiner, Pressey ...	20	30	50	20	5	125	25·0
Moll, E. E.	...	25	58	40	...	123	24·6
Feder, H.	17	8	42	30	25	122	24·4
Gardiner, J.	...	...	58	57	...	115	23·0
Rabone, H.	24	60	...	...	25	109	21·8
Baker, H. E.	23	44	..	..	30	97	19·4
Eastwood, E. W. ...	...	...	...	85	...	85	17·0
Hicks, John	..	64	..	.	...	64	12·8
Lawrance, B.	...	60	..	...	...	60	12·0
Goldsworthy, L. J. ...	...	...	46	...	...	46	9·2
McDonald, Alex. ...	...	..	38	...	...	38	7·6
Sherriff, F. J.	...	...	20	...	...	20	4·0
Neilson, Miss L. ...	...	...	100	..	...	100	20·0
Vivian, Miss A. ...	...	...	99	...	..	99	19·8
McCallum, Miss L. ...	..	...	95	..	...	95	19·0
McCallum, Miss M. E. ..	...	...	94	...	...	94	18·8
Eastwood, Mrs. E. W. ...	...	...	94	..	..	94	18·8
Wastell, Miss H. ...	...	...	93	...	...	93	18·6
Link, Miss A. ...	...	...	90	...	...	90	18·0
Nicholls, Miss M. ...	...	...	90	..	...	90	18·0
Coutts, Miss O. ...	...	...	90	...	...	90	18·0

WARRACKNABEAL.

Student's Name.	Lee.	Ruddock.	Hawkins.	Haile.	Kenyon.	Total.	Percentage of Maximum.
Bartram, R.	90	56	89	100	80	421	84·2
Bennett, J.	60	73	89	95	70	387	77·4
Bryant, G.	65	82	100	70	55	372	74·4
Sherriff, H. A. ...	28	76	98	80	...	282	56·4
Harris, W. E.	25	38	70	65	45	243	48·6
Clarke, W. J.	32	56	30	62	30	210	42·0
Heath, J.	20	40	55	60	10	185	37·0
Kelm, Max	8	35	40	51	35	168	33·6
Robinson, D. S. ...	5	37	30	55	30	157	31·4
Couzner, A. T. ...	15	10	45	50	25	145	29·0
Hayter, F.	...	...	50	75	..	125	25·0
Gildea, G.	...	...	55	66	...	121	24·2
Abbott, W.	...	...	50	62	...	112	22·4
Nottle, R. F.	...	...	50	60	...	110	22·0
McLean, L., jun. ...	...	...	40	60	...	100	20·0
McLean, H.	...	...	40	55	...	95	19·0
McIntyre, F.	...	...	35	55	...	90	18·0
Hewitt, E.	...	...	35	50	...	85	17·0
Kinghorn, F. R. ...	...	...	40	30	...	70	14·0
King, E. H.	...	...	15	40	...	55	11·0
Aitkin, C. E.	...	...	30	20	...	50	10·0
Noske, F.	...	...	15	...	...	15	3·0
Cook, Mrs. R.	...	...	35	10	...	45	9·0

DONALD.

Student's Name.	Rudduck.	Hawkins.	Haile.	Kenyon.	Adcock.	Total.	Percentage of Maximum.
Pearse, W. N. ...	80	80	75	80	90	405	81·0
Moore, W. T. ...	76	85	85	65	85	396	79·2
Pearse, E. E.	50	60	62	85	90	347	69·4
Tyson, A.	74	65	98	...	93	330	66·0
Leslie, J. M.	55	65	55	80	75	330	66·0
Hepworth, W. ...	30	59	80	30	85	284	56·8
Harris, E. A.	90	...	..	70	60	220	44·0
Morgan, E.	...	45	90	...	...	135	27·0
Moore. E. F.	...	59	67	...	...	126	25·2
Adams, S. J.	...	65	57	...	...	122	24·4

MURCHISON.

Student's Name.	Lee.	Rudduck.	Hawkins.	Haile.	Boyd.	Total.	Percentage of Maximum
Orr, J. A.	85	63	60	55	75	338	67·6
Brisbane, W. B. ...	45	56	95	97	15	308	61·6
Blaikie, C. S.	35	60	66	73	45	279	55·8
Welfare, G. W. ...	50	45	75	85	15	270	54·0
Tobe, C.	88	53	25	70	30	266	53·2
Orr, Wm. R.	63	50	40	95	15	263	52·6
Brown, R.	50	70	30	45	5	209	41·8
Gregory, H.	30	65	...	95	..	200	40·0
Harper, A.	45	82	...	...	55	182	36·4
Porter, Wm.	51	30	...	...	10	91	18·2
Murray, J. P. ...	...	...	30	40	...	70	14·0
Keady, T. F.	...	...	30	40	...	70	14·0
Clark, J. P.	..	...	25	40	...	65	13·0

NUMURKAH.

Student's Name.	Lee.	Rudduck.	Hawkins.	Haile.	Archer.	Kenyon.	Total.	Percentage of Maximum.
Moss, H. J. ...	25	86	40	48	98	57	354	59·0
Chapman, R. ...	45	50	60	35	97	55	342	57·0
McDowell, R. M. ...	73	46	70	...	90	60	339	56·5
Hick, D. P. ..	25	86	55	25	97	50	338	56·3
Rowe, W. ...	12	70	35	40	94	35	286	47·6
Moss, F. G. ...	40	65	10	45	92	20	272	45·3
Mortimer, J. ...	40	55	5	35	94	30	259	43·1
Fairless, W. S. ...	20	62	25	30	94	25	256	42·6
Graham, A. ...	30	58	30	48	75	10	251	41·8
Armstrong, W. ...	33	...	...	50	96	50	229	38·1
Harvie, W. C. ...	...	60	55	...	94	...	209	34·8
Sullivan, H. ...	60	40	55	...	...	35	190	31·6
Armstrong, R. ...	...	35	30	30	90	...	185	30·8
Bourchier, M. ...	10	10	...	35	86	25	166	27·6
Gordon, R. C. ...	...	68	85	...	.	...	153	25·5
Morris, F. ...	...	66	35	...	...	...	101	16·8
Armstrong, A. E....	...	53	15	30	...	...	98	16·3
Bennett, C. A. ...	...	...	...	...	97	...	97	16·1
Hick, C. D. ...	...	...	...	...	94	...	94	15·6

NUMURKAH—*continued.*

Student's Name.	Lee.	Rudduck.	Hawkins.	Haile.	Archer.	Kenyon.	Total.	Percentage of Maximum.
Knox, J.... ...	...	55	35	...	...	...	90	15·0
Bourchier, C. ...	...	...	...	...	89	...	89	14·8
Thomson, T. ...	...	55	30	...	...	...	85	14·1
Moss, Wm. ...	...	...	...	...	80	...	80	13·3
Hick, S.	...	...	...	...	70	...	70	11·6
Sullivan, J. ..	...	60	...	...	...	...	60	10·0
Bunnell, C. A. ...	...	53	...	...	...	...	53	8·8
McDonald, R. ...	...	...	...	50	...	...	50	8·3

NAGAMBIE.

Student's Name.	Lee.	Rudduck.	Hawkins.	Haile.	Archer.	Kenyon.	Total.	Percentage of Maximum.
Furlong, J. ...	80	60	35	85	93	60	413	68·8
Donovan, T. ...	60	42	50	82	94	...	323	54·6
Wilson, J. W. ...	42	55	36	50	88	50	321	53·5
Baud, W. C. ...	40	74	50	50	82	45	296	49·3
Baud, H. C. ..	5	50	50	70	93	25	293	48·8
Wilson, W. H. .	45	58	36	50	70	30	289	48·1
Adams, J. ...	26	68	35	55	82	...	266	44·3
Tweddle, R. ..	38	52	20	50	70	30	260	43·3
Baud, H. B. ...	40	40	40	70	85	62	252	42·0
McKinley, R. J. ...	40	50	20	55	80	45	245	40·8
Orpwood, T. ...	20	5	50	45	70	40	230	38·3
Smith, G. ...	45	80	...	...	82	...	207	34·5
Boddey, A. ..	60	38	30	62	...	...	190	31·6
Adams, W. ..	10	20	6	55	85	10	186	31·0
Furlong, F. ..	45	30	...	...	91	...	166	27·6
Ryan, E. J. ...	..	...	40	50	...	...	90	15·1
Dolphin, O. ..	...	...	90	...	...	...	90	15·1
Muller, J. ...	...	...	..	75	...	...	75	12·5
Hudson, A. J. ...	...	...	20	50	...	...	70	11·6
Dwyer, M. D. ...	...	...	6	40	...	...	46	7·6

DUNOLLY.

Student's Name.	Lee.	Rudduck.	Hawkins.	Adcock.	Archer.	Kenyon.	Total.	Percentage of Maximum.
Forbes, J. ...	77	73	90	80	92	60	474	79·0
McPherson, W. ...	80	73	70	75	91	75	464	77·3
Howard, J. ...	65	65	42	75	94	78	419	69·8
Nixon, F. D. ...	64	42	70	75	89	50	390	65·0
Howard, C. W. ...	81	54	50	75	91	...	351	58·5
Costello, P., jun. ..	60	55	60	60	92	10	337	56·1
Dam, H. H. ...	58	50	45	50	95	35	333	55·5
Lummis, J. ...	70	25	40	65	83	50	333	55·5
Melton, J. ...	50	60	40	50	91	35	326	54·3
Freemantle, Jas. ...	54	50	40	35	82	35	296	49·3
Freemantle, J, (Mt. Hooghly) ...	70	20	55	...	95	...	240	40·0
Freemantle, J. (Bet Bet)	25	20	...	...	...	...	45	7·5

BALLARAT.

Student's Name.	Lee.	Rudduck.	Hawkins.	Haile.	Archer.	Kenyon.	Total.	Percentage of Maximum.
Kerry, C. H. ...	45	66	90	40	95	73	409	68·1
Adeney, J. H. ...	50	80	85	50	85	53	403	67·1
Adeney, E. M. ...	48	70	45	55	90	60	368	61·3
Robinson, J. B. ...	36	...	90	...	84	...	210	35·0
O'Hara, J. ...	...	33	...	10	30	70	143	23·8

PRIZE WINNERS.

The honour of winning the gold medal offered by the Australian Natives Association for the student gaining the best aggregate of marks in all subjects, belongs to Nhill. Mr. H. A. Dahlenberg, a young farmer of that district, secured an aggregate of 530 marks out of a possible 600, or 88.3 per cent. of the maximum possible. A scrutiny of the points awarded at each centre will show that there were many excellent papers, and the winner had no easy task to carry off the prize from 252 competitors. It is worthy of remark that Mr. Dahlenberg was a student at the Nhill class in 1904, on which occasion he did not go up for examination. It is most gratifying to find a young farmer, already having a sound practical knowledge of agricultural methods, recognising the advantages of education in the more technical side of his occupation, and there is every reason to believe that the instruction so gained will not be lost to the district in which he resides.

The members of the Corio Shire Council subscribed the sum of £25, to be applied to the encouragement of agricultural education in the Geelong district. It has been decided to allot £5 to form the nucleus of a library of books on agricultural subjects for the Students' Association, and the balance will be awarded as a scholarship in the Agricultural High School, which it is proposed to establish shortly in Geelong.

Prizes of medals, trophies, books, or cash, were donated by leading residents of the Nhill, Geelong, Stawell, Kaniva, Donald, Murchison, and Nagambie districts. The prizes have been awarded on the basis that no student could win more than one prize for individual subjects but was eligible to compete for the "best aggregate," where offered, as well. The following are the awards of prizes:—

NHILL.

Several prizes were offered for individual subjects, and for attendance, the allotment of which was left in the hands of the Nhill Agricultural and Pastoral Society.

GEELONG.

Agricultural Subjects.—1st, J. Farrer, 10s.; 2nd, H. L. Stewart, 5s.
Veterinary Science.—1st, F. Grace, 10s.; 2nd, A. J. Fargie, 5s.
Surveying, &c.—1st, A. J. Fargie, 10s.; 2nd, H. L. Stewart, G. Anderson, 5s.
Dairying.—1st, H. L. Stewart, F. Grace, J. F. Farrer, 15s.
Poultry.—1st, H. L. Stewart, J. F. Farrer, A. J. Fargie, F. Grace, O. E. Crossley, F. D. Ritchie, 15s.
Wool Sorting.—1st, G. Anderson, 10s.; 2nd, J. F. Farrer, 5s.

STAWELL.

Agricultural Subjects.—1st, J. A. McMurtrie, 10s.; 2nd, A. Vance, 5s.
Veterinary Science.—1st, A. M. Reading, 10s.; 2nd, W. A. Whitehead, 5s.
Wool Classing.—1st, J. C. Hutchings, 10s.; 2nd, W. A. Kilpatrick, 5s.
Poultry.—1st, Mrs. Cato, 10s.; 2nd, Mrs. Grieve, Miss Cook, 5s.
Prize for Best Aggregate, given by the Stawell Agricultural and Pastoral Society.—J. A. McMurtrie, £2 2s.

KANIVA.

Agricultural Subjects.—1st, L. C. McCallum, 7s. 6d.; 2nd, C. Sanders, 2s. 6d.
Veterinary Science.—1st, A. Schmidt, 7s. 6d.; 2nd, F. Goodwin, 2s. 6d.
Wool Classing.—1st, E. G. Rowe, gold medal; 2nd, A. E. Sanders, 10s. 6d.
Poultry (open to ladies only).—1st, Miss L. Neilson, gold medal.
Poultry (open to all students).—1st, Miss L. Neilson, 7s. 6d.; 2nd, Miss A. Vivian, 2s. 6d.
Highest Number of Points for Kaniva Class.—1st, E. G. Rowe and L. C. McCallum equal, £1 1s.

DONALD.

Highest Number of Points at the Donald Class.—W. N. Pearse, £1 1s.

MURCHISON.

Agricultural Subjects.—C. Tobe, 10s. 6d.
Veterinary Science.—A. Harper, 10s. 6d.
Wool Classing.—W. G. Brisbane, 10s. 6d.
Poultry.—G. W. Welfare, 10s. 6d
Agricultural Surveying.—C. S. Blaikie, 10s. 6d.
Highest Number of Points at the Murchison Class.—J. A. Orr, 10s. 6d.

NAGAMBIE.

Highest Number of Points for the Nagambie Class.—J. Furlong, gold medal.
Highest Number of Points Combined with Best Attendance.—T. Donovan, J. W. Wilson, medal.

REPORTS BY THE LECTURERS.

Mr. F. E. Lee.—"I have been much impressed by the genuine desire of the students at all centres, to acquire full information on the subjects dealt with by me. The functions of artificial fertilizers, their valuation, and the results of the experimental work throughout the State appeared to evoke a live interest everywhere. I remarked that there is still a noticeable want of knowledge in the estimation of the value of the various fertilizers on the Victorian market. The fact that the list of unit values is published annually in the *Journal*, brought forth a number of subscribers to that publication. I have every reason to be satisfied with the general work of the classes, and can only regret that other duties precluded a more lengthy visit to each centre."

Mr. H. S. Rudduck, G.M.V.C.—"The results of the work of each class are satisfactory. I think that evening lantern lectures are a valuable aid to my work. All the practical work was splendidly attended, and considerable interest was displayed in the work of my colleague, Mr. Kenneally, at his farriery demonstrations."

Mr. A. S. Kenyon, C.E.—"To expect students to grasp such a subject as agricultural surveying, and the principles of water conservation in a few brief hours, is optimistic in a high degree. It necessitates a considerable addition to the average student's vocabulary, and calls for mental processes of an unfamiliar nature. Still, with all these drawbacks, many of the papers evince a distinct understanding of the questions, while almost all show that only a little more time was needed to obtain a better grip of the

subject. It is evident, from the answers to questions on water conservation, that the subject, being more familiar, was clearly understood. After lecturing at seven centres, and after contact with a large number of students, I am convinced much more time should be devoted to the classes, both in extension of time allowed for each subject and in the enlargement of the subjects themselves. Continuation work should not be forgotten, and the formation of agricultural students' associations should assist to this end."

Mr. R. T. Archer.—"It is very gratifying to note, on the average, a decided improvement in the papers, as compared with former years, which shows that the students have been very attentive to the lectures. As at former classes, great interest was displayed in the use of the Babcock milk tester, as a means of improving the dairy herd. I feel satisfied that this will result in a material increase in the average returns from dairy cows in Victoria."

Mr. H. V. Hawkins.—"The examination papers generally are an improvement on former years. It is worthy of remark that my subject brought forth some excellent papers by ladies. The number of junior students attending the classes this year will probably be the means of turning the thoughts of many seriously to the profits of the poultry industry."

Mr. G. H. Adcock, F.L.S.—"I was greatly pleased by the intelligent appreciation of the lectures of both centres where I lectured. The examination papers show that the students got a "grip" of the subject-matter of two vast subjects, briefly outlined in two short addresses."

Mr. D. M. Boyd.—"My subject is, at any time, a somewhat difficult one for the layman to pick up rapidly, and at the classes this was the more so on account of the brevity of the time allowed for examination. The results would have been generally more satisfactory had a greater length of time been allowed. On the whole, I am satisfied that my efforts were not in vain."

Mr. W. Haile.—"More time was spent this year in practical work, which appeared to meet with the appreciation of the students, judging by the splendid attendance everywhere. The examination papers, on the whole, were good, and from the number of letters I have received since the classes closed, I should judge that a repetition of the work in many centres would meet with an increased response from the students."

Mr. E. Plumridge.—"My work was limited to the Geelong class. The examination papers reflect credit on their authors, and I am well satisfied with the practical demonstrations of the wool classing conducted by me."

The Future Work of the Classes.

The whole scheme, viewed in the light of the experience of three years, can fairly be said to be a success. It meets a want of the younger generation of agriculturists, and being held at a period of the year when it interferes least with the ordinary work of the farm, it should, in the future, meet with ever greater success in the matter of attendance. I cannot refrain from pointing out that, while the daily attendance, as a whole, is thoroughly satisfactory, the individual attendance of students is not as regular as it should be, and to this reason I ascribe, the poor percentage of marks gained by many of the students. Certain subjects will, of course, appeal more to some students than others, but, nevertheless, an

obligation rests upon each person who enrols his name, to attend the whole course of lectures, and to submit himself for examination at the termination of the class.

It is possible that in the general scheme of agricultural education projected by the Department, the short course classes will find a place, although their constitution will probably require to be altered to fit in with other arrangements. Whatever the future may bring forth, I feel sure that the very large number of young men who have, at one time or another, attended these classes, will remember them with pleasure, and trace some of their progress to the instruction received thereat.

The harmonious relations existing at all centres between the lecturing staff and the students have played no small part in the general success of the work. To the local secretaries, and also to the general public at each centre, I am asked by colleagues to acknowledge with thanks their appreciation of the many courtesies shown them during the term of the class.

SURVEYING ON THE FARM.

A. S. Kenyon, C.E.

The great majority of the ordinary operations of surveying and levelling are well within the powers of persons of ordinary intelligence and acquirements. Knowledge of the elementary methods of arithmetic is, of course, required, and some practice in their application is advisable. Nothing more difficult than the extraction of the square root of a number is called for, though for most questions simple multiplication and division will be sufficient. The farmer will need to add some few words to his vocabulary; but these will not be many, while all methods given will be simplified as far as possible consistent with accuracy. A certain number of appliances and instruments will be required. These, for the most part, can be made by the farmer himself, while the others will cost but little. Descriptions and directions will be given as they are referred to.

Chain Surveying.

RANGING THE LINK.

Surveying consists of measuring lengths of lines, ascertaining areas and volumes, and fixing positions of points. As a preliminary to measuring the length of a line, it is necessary, as a rule, to range it out. For this, there are required two or three poles (Fig. 1) made of wood or iron, quite straight, about one inch or a little more in thickness, and some six

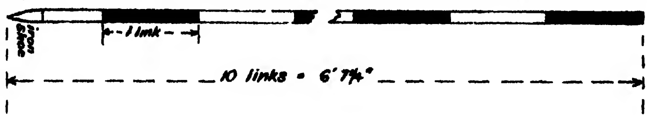


FIG. 1.

feet in length. It is well to shoe them with iron if they are to be frequently used. For convenience in sighting, they should be painted white and black, or white and red, in alternate strips of one link in length.

Thus marked, they will serve as measuring rods for short distances of under ten links. In use, the pole must be put in vertically—that is, perfectly upright. This may be done with the eye by the use of a plumb-bob, or by standing with the feet close together, and with the toes touching the bottom of the pole, the latter being upright when it touches the nose of the observer. Of course, stout men will find this last method somewhat difficult. To range the line, stand over the starting point or peg, and, sighting by a plumb-bob held directly above the peg, direct the assistant to put a pole in the line required. The pole should cover the object to which the line is being ranged. Further poles may be put in as required, care being taken that all are vertical. Instead of a plumb-bob, a pole may be put in at the starting point, and the observer may sight from it, keeping, however, some distance back from it. It is at times impossible to see the distant object from the starting point, owing to an intervening rise, or other cause. If there is any part from which both the distant object and the starting point can be seen, a pole may be put in true line by the following method:—Put one pole in line as near as you can guess it. For this purpose, an easy method is to stand with the arms extended full length, and sight along the tips of the fingers of each alternately, moving backwards or forwards until apparently in the true line. After putting the pole in, go as far as possible with another pole, or send an assistant, and range it in line with either the distant object or the starting point. If on the true line, the two poles will be in line viewed from either end (Fig. 2). If not, let the assistant range your pole with the other end. This done, range him again into line, and repeat this until both poles are in

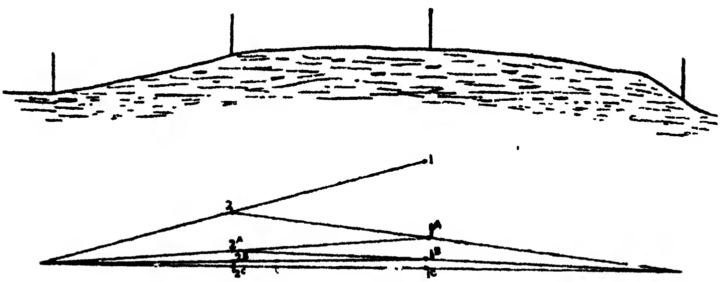


FIG. 2.

line looking from either end to the distant object or the starting point. Reference has been made to the plumb-bob. This need hardly be described, as it may be made from anything fairly heavy. It should, however, be hung truly. This may be ascertained by spinning it round on the end of its string. If true, it will run steadily; if not, it will wobble.

CHAINING.

Having ranged out the line, the next operation is to chain it, that is, to measure the number of chains and links in its length. For this, there are required chain and arrows. The chain should be of metal, either steel tape or iron links. The steel tape is preferable, as it remains practically correct, while the iron link chain is liable to stretch considerably. A steel tape chain, one-half inch in width and 100 links in length, on a cross or winding frame, will cost about 25s., while an iron link one, if procurable, may be obtained for 7s. 6d. or 10s. The metallic box tape is seldom

accurate enough for decent work, it being generally too short when new, and too long when old; errors of 4 inches and over per chain are common. Arrows (Fig. 3) are made readily from No. 8 ordinary black wire, and should be ten in number. It is well to tie pieces of red cloth on the rings

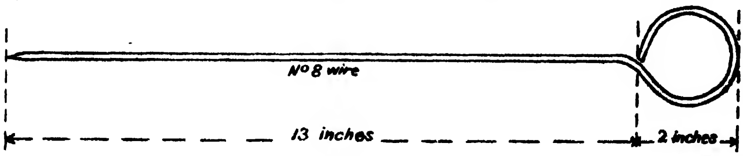


FIG. 3.

of the arrows, so that they may be more easily seen. Two persons are needed for chaining. One, generally the more experienced, is termed the follower; the other is called the leader. The leader takes the ten arrows and one handle of the chain. Proceeding in the required direction, he stretches the chain along the ground as nearly in the line as possible. The follower, holding his handle on the ground at the starting peg, directs the leader into the true line. When this is done, the leader puts in an arrow at the end of the chain, taking care to keep the chain straight and tightly strained. The leader must stand or crouch sideways while doing this, so that the follower may have an unobstructed view of the distant object. The leader then goes on, throwing the chain a little to one side, so that in drawing it along it will not touch the arrow just put in. The operation of stretching, sighting, and marking is repeated. The leader goes on again, and the follower picks up the arrow. When the leader has put in his tenth arrow, that is, after measuring ten chains, the follower comes up to him, letting the chain lie upon the ground, puts in a temporary mark, such as a knife or pencil, in place of the arrow, and hands the whole ten arrows back to the leader, who should satisfy himself that he has the full number. A note of the ten chains is made in the book, and operations proceed as before. If these directions are carefully attended to, there need never be any doubt as to the distance chained. The distance measured is the number of chains noted in the book, with the number of arrows in the hands of the follower added, together with the number of links from the last arrow to the end of the line.

CHAINING ON A SLOPE.

In measuring lines to ascertain areas, it is essential that all measurements be made on the horizontal. One or both ends of the chain will be

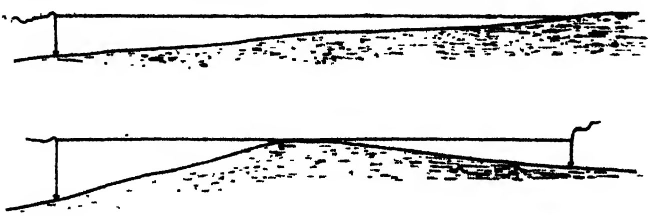


FIG. 4.

off the ground, according to the slope. Marking the end is then done by the plumb-bob (Fig. 4). All areas are given horizontally. A glance at the accompanying sketch will illustrate the necessity for this. All growth

is vertical, and so are all buildings. In the sketch, the horizontal line is divided into equal parts, and vertical lines drawn from them. It will be seen that, although the sloping line is longer than the horizontal one, it will only carry the same number of vertical lines, spaced similarly (Fig. 5). Therefore, no matter what the slope is, the horizontal measurements govern the number of plants which can be grown, as well as the number

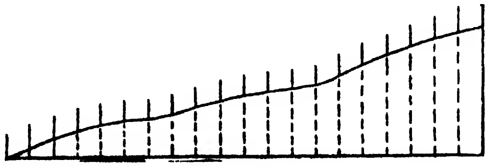


FIG. 5.

of buildings, fence-posts, &c., which can be erected. The wire required for fencing will, of course, be longer, as it follows the contour of the ground. The slope must be considerable before it is necessary to resort to the plumb-bob. The following table will show this:—

Slope.		Error in Chaining along Ground.
1 in 20	... ...	.1 per cent. too great.
1 in 10	... ...	.5 ,, ,, ,, ,,
1 in 5	... ...	2.0 ,, ,, ,, ,,
1 in 4	... ...	3.0 ,, ,, ,, ,,

CHAINING PAST OBSTACLES.

In chaining a line, obstacles are sometimes met with which prevent the foregoing instructions being carried out in their entirety. A simple case is that of a water-hole not too wide to stretch the chain across, but into which the end of the chain would go in the ordinary course. In this case, measure up to the edge, put in a temporary mark, for convenience, at an even number of links, stretch the full length of the chain from the temporary mark across the obstruction, and put in an arrow at the end. Then, instead of running the chain out full length, stop it at the same linkage as measured up to the edge of the obstacle, stretch as usual, and put in an arrow at the end. The rule is, only put in arrows at the leader's end, or

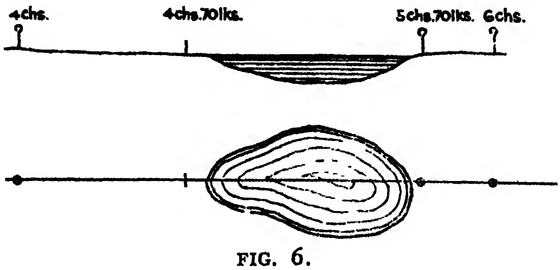


FIG. 6.

handle of the chain. When measuring distances, at any other point put in a temporary mark. For example, suppose the edge of the water-hole was at 4 chains 70 links, then the full-stretched chain across it will give the next pin at 5 chains 70 links; but the next measurement starts at the 70-link mark on the chain; consequently there are only 30 links to the next arrow, which gives the correct distance of 6 chains (Fig. 6). The link

mark used must be noted at the time, as the memory should never be trusted in surveying work. Keeping full and copious notes will save much trouble and annoyance.

If the obstacle be too wide, or if it be impassable, such as a building or a haystack, set out a chain or so back from the obstacle a perpendicular, that is, a line at right angles to the line being chained, then chain along the perpendicular a sufficient distance, generally, for convenience, in even chains, to clear the obstacle. Put in an arrow. Note the number of chains. Lay off another line at right angles to the chainage line, and close to the obstacle, and chain out the same number of chains as before, putting in an arrow at the end. You will then have two arrows in a line parallel to the chainage line, and at a known number of chains from it. The parallel line may now be extended far enough to clear the obstacle, the chainage being counted from the last arrow. A perpendicular to this line is then set up in the opposite direction to those previously set up, and the same number of chains as measured off before in the first perpendicular marked off. The point thus found will be in the original line of chainage, and will be at a distance found by adding the chains measured in the parallel line to those measured up to the obstacle. The diagram (Fig. 7) will make the operation clearer. If the obstacle cannot be sighted through to give

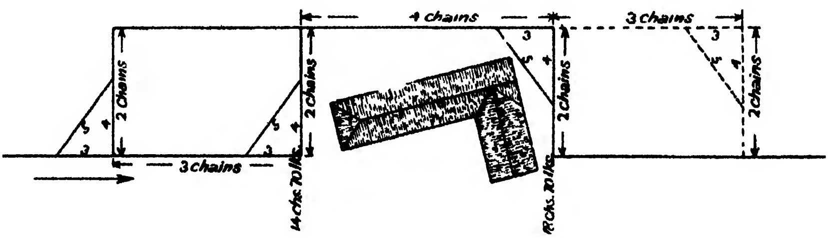


FIG. 7.

the original direction, the parallel line must be further extended, and a second perpendicular set up on the far side of the obstacle, the same number of chains marked off, and an arrow put in. The two arrows will be in the original line with the chainage given to the first. The line may then be ranged out and chained ahead as usual. The extra work necessary to get the direction beyond a lofty obstacle is shown in the diagram by the dotted lines. Occasionally another method will be found more suitable; for instance, when the obstacle is long and narrow, and there is insufficient room for the perpendicular method. This is the equilateral or equal-sided triangle method. Chain up to a suitable point, note chainage, then set up an equilateral triangle. This is done by putting in an arrow, say, 50 links further on. Hold the handles at end of chainage and at the arrow, and take the chain by the middle—that is, the 50-link mark—strain tight, and put in an arrow. The result will be a triangle, having all three sides equal, 50 links each in the case given, and having one side in the direction of the original line. Range out the side furthest from the obstacle, and chain along it until clear; note the number of chains, then set out another equilateral triangle, extend the further side the same number of chains as the previous extension, and put in an arrow. The arrow will be in the original line, and at a chainage found by adding the number of chains of

the extended side to the original chainage. The diagram (Fig. 8) shows clearly the method. If the obstacle cannot be sighted through, the original direction may be obtained by setting out another equilateral triangle, as

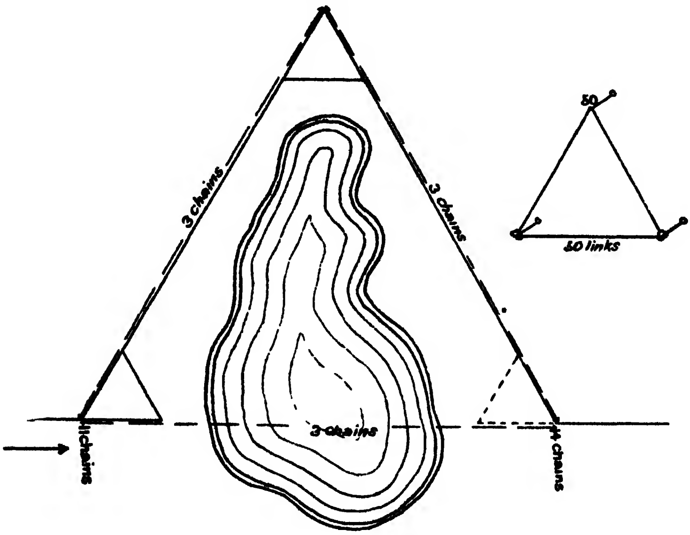


FIG. 8.

shown by dotted lines in the diagram. The base of this triangle will give the original direction of the line, which may be ranged from the two arrows at the angles of the base.

SETTING OUT RIGHT ANGLES.

The setting out of a line perpendicular—that is, at right angles—to the chainage line may be performed in several ways. The most simple and generally the most useful method is by what is known as the 3, 4, 5 method. Advantage is taken of the fact that any triangle having its sides in the proportion of 3, 4, and 5, has one of its angles a right angle. To set up a line at right angles to a point in the chainage line by this method, measure off 40 links, either backwards or onwards along the chainage line. Put in arrows at the point from which the perpendicular is to be set off, and at the point 40 links from it. Have the handles of the chain held at each of the pins, and, taking the chain by the 50 and 30 link marks, stretch tight and put in an arrow at the intersection of the marks. (See Fig. 9.) To get the line at right angles to the desired point, the 30 mark must be taken, starting from that point. The rule is—the short line of the two strained lines is at right angles to the chainage line. Any multiple of the figures given may be used so long as the proportion 3, 4, 5 holds. For instance, 15, 20, 25, or 60, 80, 100 will give the same result. Another method is by the use of the equilateral triangle, the setting out of which has been already described. Set out such a triangle. Then swing round the handle of the chain until it comes in a line with the other two arrows, and put in an arrow. This arrow will be at right angles to the point from

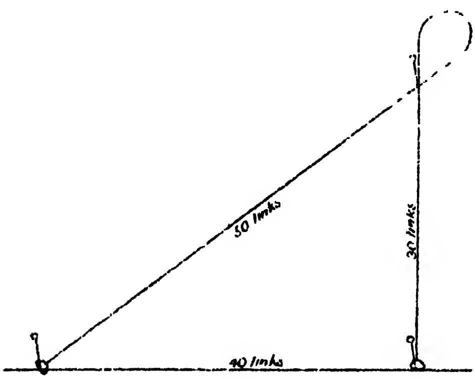


FIG. 9.

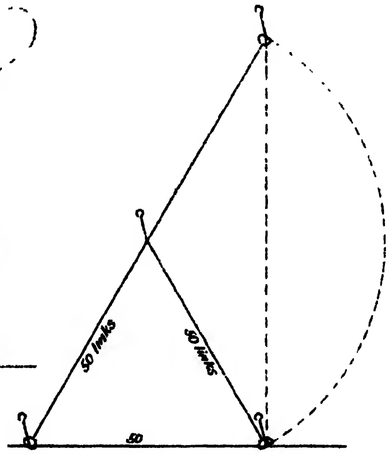


FIG. 10.

which the handle was swung. (See Fig. 10.) This method has the advantage of requiring the use of only one mark on the chain, and can in fact be employed without a marked chain at all. Using, for instance, a pair of reins, the base may be set out with the reins doubled, then opened and held at the ends of the base, and an arrow put in at the centre of the reins. The half-rein may be swung round as before, and the

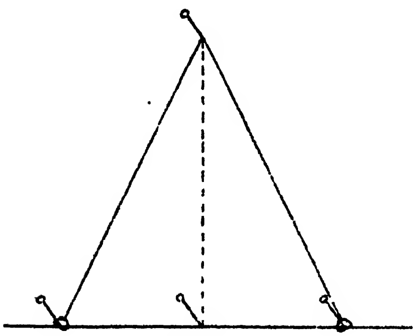


FIG. 11.

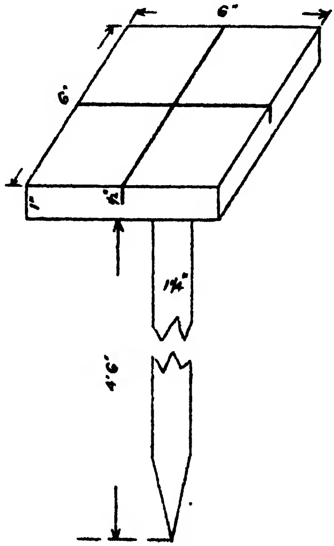


FIG. 12.

perpendicular point obtained. Still another way is to measure off equal distances on each side of the point, put in arrows, hold the ends of the chain at them, and, holding the centre mark, pull tight and put in an arrow, which will then be at right angles to the point (Fig. 11). This

method is also adapted for use by a rope or reins when no chain or other appliance is available. If much work, involving setting out perpendiculars, is required, a cheap instrument called the cross-staff (Fig. 12) should be employed. Take a piece of board about 6 inches by 6 inches; the shape is not a matter of consequence. Plane one side smooth, and on the smooth side draw two lines at right angles to one another, using a carpenter's square or a set square. Make sure that the lines are exactly at right angles by reversing the square, and by measuring carefully the same distance along each line from its intersection, and trying if the points so found are at exactly equal distances apart, as they should be. Having been satisfied that the lines are true, nail or cleats or guides, and cut with a saw two grooves along the lines, about ½ inch deep. Make the grooves clean, as they are required for sighting through. The piece of wood may then be nailed on a staff, pointed at one end, about 4 feet 6 inches in length. The cross-staff is used to set off a perpendicular to the chainage line, thus: Place the instrument vertically on the line. Turn it round until the distant object or the starting point can be seen through one of the cuts, that is, the cut is exactly in line with the original chainage line. To make sure, sight through the cut from each end. Then the assistant may be directed, by sighting through the other cut, where to put in a pole or peg at right angles. If the instrument be properly made, the pole will be in the correct position if it be turned through a quarter-circle, using the perpendicular cut to sight the chainage line, and the other,

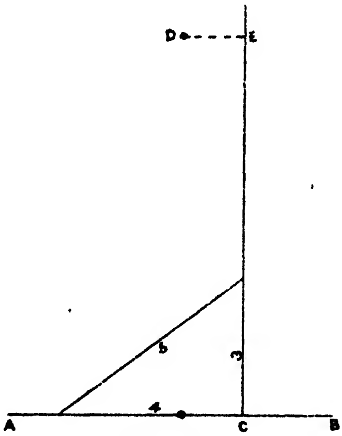


FIG. 13.

which was before used to sight the chainage line, to set out the perpendicular. For much work, such as measuring perpendicular distances of points, or setting out off-sets, the eye alone may be used. Standing exactly on the line, stretch out the arms at full length. Then, by sighting, make the hands point to each end of the chainage line, still keeping the arms fully extended. Then slowly and carefully bring the arms around at full length until the hands meet. A line sighted between the thumbs will give very approximately a perpendicular. In setting out right angles by the chainage methods to measure the perpendicular distance of a certain point, as, for instance, in measuring the areas of irregular paddocks, the line will not, as a rule, pass through the point.

It will, however, pass so close that the true distance can easily be ascertained. But the exact distance on the chainage line of the starting point of the perpendicular is frequently required. Suppose the perpendicular distance of the point D from the line AB is required. Fix the point C as nearly as can be estimated in the right position. Set out the right angle by any of the chainage methods already explained. Chain along the line so found until opposite the point D. The distance CE is the true perpendicular distance of D (Fig 13). Then measure the distance DE, and add it to, or subtract it from, as the case requires, the chainage, already noted, of C, thus obtaining the actual distance of the perpendicular line passing exactly through D.

INACCESSIBLE OBJECTS.

The operations so far described cover most of the ordinary work of surveying with the chain. Before going on to the other branches of survey work, some special cases presenting difficulties may be dealt with. They will also serve to illustrate the use of some of the methods already given. It may be found necessary to measure the distance to an object which is inaccessible; perhaps across a river or a swamp. In Fig. 14 it is required to measure the distance from A to B, where a river flows between them.

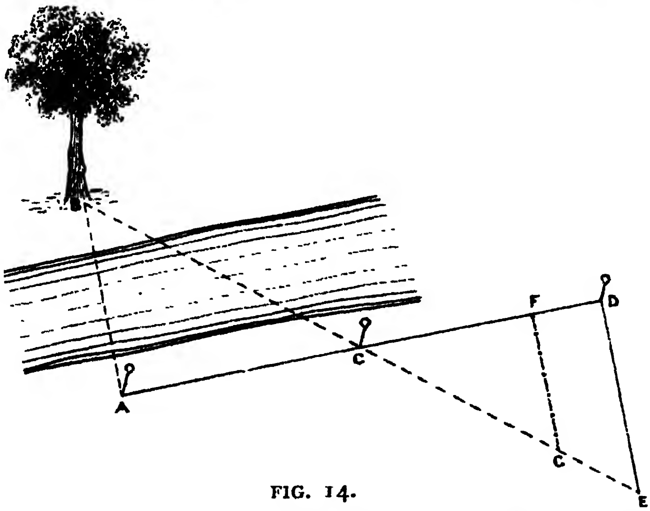


FIG. 14.

Set off at A a perpendicular to the line AB, chain along the perpendicular for a distance roughly equal at a guess to the length of AB, making it for convenience an even number of chains. Put in a pole or arrow, C. Continue chaining to D, making the distance on from C equal to the chainage from A to C. Then at D set out another perpendicular to the line ACD, and chain along it to E, E being in line with B and C. The distance chained from D to E is equal to the distance from A to B, which could not be got at. The distance DE being exactly equal to AB depends upon CD being equal to AC. Should the space available be limited, CD may be made smaller. In that case DE will be in the same proportion to AB as CD is to AC; or, in other words, AB will equal the distance from D to E, multiplied by the distance from A to C, and the result divided by the length CD.

Thus AB = (DE × AC) ÷ CD. If, for instance, the distance AC be 4 chains, and CD 2 chains, or one-half of AC, then DE will be one-half of the required distance AB. The reason for making the distance approximately equal to AB is to form what is known as a "well-conditioned" triangle of ABC. A "well-conditioned" triangle is one that has all its angles nearly equal. In such a case, the intersection, or crossing of lines, can be accurately found, as, for instance, the crossing of the lines DE and BCE; while if they had crossed at a very flat or acute angle, the intersection could not, in the field, be determined within a few links.

Should room be scanty, another method involving less space may be employed to find the distance of an inaccessible object. Again, let AB (see Fig. 15) be the distance required. As before, set off a perpendicular at A, chain AC making it nearly equal to AB, although in this case it is

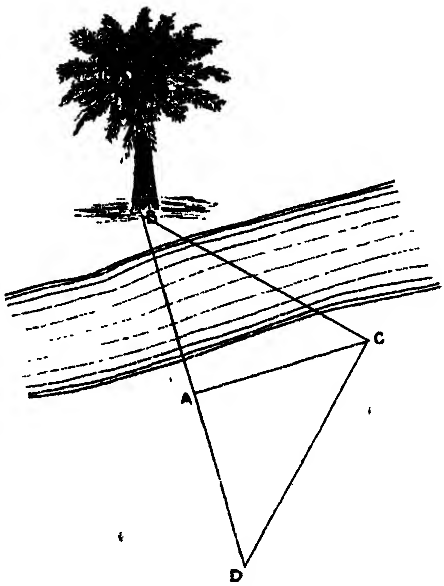


FIG. 15.

not so important. Set out at line at C, perpendicular to BC; range out the perpendicular until it cuts the line of AB at D. It need not be chained. Then chain from D to A. The distance required, AB, bears the same proportion to AC as AC does to AD, so that AB equals the distance AC multiplied by itself and divided by the distance AD. Thus AB = AC^2 ÷ AD.

The height of a tree, a stack, or other object may, when not easily measured directly, be found as follows:—Set up a pole, as tall a one as procurable, truly vertical; find by sighting the point on the ground where the line through the tops of the object and of the pole cuts it. (See Fig. 16.) Then the height of the object is in the same proportion to the height of the pole as the distance from the object to the cutting point is to that from

the pole. Using the letters on the diagram, the height AB is to CD, the height of the pole, as AE is to CE. Thus AB = (CD × AE) ÷ CE.

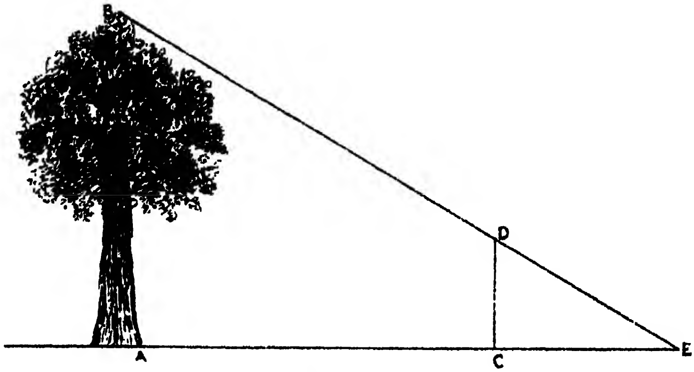


FIG. 16.

The point A must be directly below B, and the line AE must be uniformly sloping; it need not be horizontal.

GENERAL HINTS.

In all chainage work, see that the chain is straight, and well strained; that all poles and arrows are put in vertically and firmly; that all triangles are, as far as practicable, well-conditioned; and that careful and copious notes of all measurements, with sketches of lines and figures, are kept. Careful attention to the directions and to the above hints will produce work good enough for all ordinary requirements. The practical application of chain surveying to the measurement of areas and quantities will be given later.

ANGULAR SURVEYING.

Angular surveying, that is, the measurement of the angles between lines, as well as of their lengths, requires the use of instruments. Instruments, unless in the hands of trained observers, are usually dangerous, while their use requires a considerable amount of experience and skill. A farmer may find at times a prismatic, or other form of compass, of some service; but he will be well advised to leave all instruments requiring adjustment severely alone. Such survey work will be seldom required, and, when it is, it will be safer to call in the services of a professional man.

THE ORCHARD.

James Lang, Harcourt.

Owing to the late season, cherries are still plentiful in the market, which is a most unusual occurrence at this season of the year, as they are generally finished by the first week in January. Accounts complaining of light crops of all kinds of fruit have been received from nearly all fruit districts. In no district has the crop come up to expectation. The hot winds have been the chief cause of the failure, causing the young fruit to drop prematurely. It is to be hoped that better prices will rule for fruit, and thus compensate the grower for the small crop he has for disposal. If this month should turn out to be dry, irrigation will have to be resorted to where water is available. It is a mistake to put off irrigating the orchard till later in the season. The aim of the grower should be to keep the fruit growing on without a check. Keep the ground well stirred, and free from weeds, especially where the ground has been irrigated. This prevents evaporation and keeps the ground from caking. Citrus fruits should be kept well watered, as they suffer more than other trees from lack of moisture. Strawberries also will require attention; a good soaking of water now will induce the plants to bloom again, and so secure a second crop. Keep the spray going for codlin moth; also look over bandages to destroy any grubs that are harbouring under them. Growers who intend shipping a portion of their crop should make arrangements for cool chamber space as early as possible. The quantity available is limited, and should applications be too long delayed, growers may not be able to obtain sufficient for their requirements. It is very unfortunate, at the present time, that the German Government, in the new Tariff which comes into operation on the 1st March, 1906, has imposed a duty of 2s. 6d. per cwt. on apples imported into Germany. This will be a great check on exportation to that country, and will cause shippers to pause before consigning fruit there. During the last shipping season, 9,000 cases of apples were shipped direct to Germany, and the prices realized were about on a par with London returns. The German expenses, however, are rather more than what obtains in shipping to London. The additional expenditure, on account of duty, will make the charges unduly large in proportion to the prices realized. This is very much to be regretted, as, no doubt, in the course of a few years, a very much larger trade would be opened up with Germany and other Continental countries.

It is to be hoped that growers who consign their fruit to oversea markets will see that fruit of a suitable size, carefully graded and packed, is sent. Cases of a bushel capacity should be used. The small size of the cases in which some growers consign their fruit, was the cause of great complaint in London last season. This bad practice should be stopped at once, and only cases of full bushel capacity sent, and so maintain the favorable position which Victorian apples have gained on the London market. The inside measurement of export bushel cases should be 18 x 14 x 9 inches, and the outside measurement 20 x 15 x 10 inches.

ARTIFICIAL MANURES ACT 1904.

The following lists, giving the results of Analyses of Manures made during the year 1905, are published with permission of the vendors. List A comprises samples taken for examination by officers of the Department from parcels of manures in the hands of farmers, or agents, or in transit. List B comprises the samples sent to the Government Laboratory for analysis by the vendors in accordance with the Act.

W. PERCY WILKINSON,

Government Analyst and Acting Chemist for Agriculture.

A.—SAMPLES TAKEN BY OFFICERS OF THE DEPARTMENT.

Sample No.	Brand of Manure.	Manufacturer or Importer.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Potash. Found.	Potash. Guaranteed.
14339	Florida Super. ..	Cuming, Smith, and Co.	..	..	20.56	20.00		
14342	" " .	" "	.		20.06	20.00		
14347	" " ..	" "		..	21.95	20.00		
14349	Grain Manure ..	" "	.	...	20.72	20.00		
14351	Florida Super. ...	" "	..	.	19.60	20.00		
14352	Grain Manure ...	" "	.	.	20.83	20.00		
14359	Florida Super. ...	" "	...	.	20.16	20.00		
14371	" " ..	" "	..	..	21.18	20.00		
14373	" " .	" "		.	21.34	20.00		
14238	" " .	" "	..		21.67	20.00		
14275	Nitro Super. ...	" "	.80	.70	23.37	19.37		
14288	" " ..	" "	.77	.70	22.93	19.37		
14294	" " ...	" "	.77	.70	22.21	19.37		
14296	" " .	" "	.75	.70	22.62	19.37		
14301	" " ...	" "	.32	.70	22.17	19.37		
14376	Potato Manure ...	" "	.75	.63	19.35	17.43	6.35	5.40
14346	Nitro Super. ..	" "	.83	.70	23.00	19.37		
14348	Bone and Super. .	" "	1.96	1.50	21.39	21.00		
14374	Nitro Super. ...	" "	.68	.70	22.24	19.37		
14375	Bone and Super. ..	" "	2.38	1.50	20.65	21.00		
14372	Thomas' Phosphate	" "	...	...	15.50	16.60		
14290	Florida Super. ...	" "	...	..	23.16	20.00		
14299	Nitro Super. ...	" "	.73	.70	19.76	19.37		
14489	Florida Super. ..	" "	...	...	19.89	20.00		
14532	" " ...	" "	...	...	20.05	20.00		
14537	" " ...	" "	..	...	20.01	20.00		
14731	" " ...	" "	...	...	19.94	20.00		
14485	" " ...	" "	...	...	20.53	20.00		
14512	" " ...	" "	...	...	20.12	20.00		
14478	Nitro Super. ...	" "	.83	.70	22.78	19.37		
14486	" " ...	" "	.83	.70	22.83	19.37		

A.—SAMPLES TAKEN BY OFFICERS OF THE DEPARTMENT—*continued.*

Sample No.	Brand of Manure.	Manufacturer or Importer.	Nitrogen Found.	Nitrogen Guaranteed	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Potash. Found.	Potash. Guaranteed.
14703	Nitro Super. ...	Cuming, Smith, and Co.	0.74	0.70	21.91	18.49		
14706	Bonedust and Super.	" "	1.58	1.50	21.12	21.00		
14506	Florida Super. ...	" "	...	...	21.18	20.00		
14489	" " ...	" "	...	...	19.89	20.00		
14492	Florida	" "	...	...	19.10	18.00		
14505	Florida Super. ...	" "	..	...	21.90	20.00		
14515	" " ...	" "	...	...	19.40	20.00		
14523	" " ...	" "	..	...	22.19	20.00		
14383	" " ...	" "	...	..	20.65	20.00		
14385	" " ...	" "	...	...	20.47	20.00		
14720	Potato Manure ...	" "	0.71	0.74	20.67	17.39	4.27	5.40
14776	" " ...	" "	0.61	0.63	18.32	17.43	5.26	5.00
14778	Leguminous Manure	" "	0.08	.	22 00	20.75	7.26	5.00
14723	Bone and Super. ...	" "	1.22	1.50	22.37	21.00		
14734	Nitro Super. ...	" "	0.82	0.70	21.53	19.37		
14727	Florida Super. ...	" "	...	...	20.91	20.00		
14332	Nitro Super. ...	" "	..	...	22.00	19.37		
14302	Florida Super. ...	" "	...	..	20.61	20.00		
14698	" " ...	" "	...	...	19.63	20.00		
14533	Orchard Manure ...	" "	...	...	18.32	15.63		
14702	Bonedust... ...	" "	2.70	2.50	20.77	21.00		
14289	"	" "	2.66	2.50	26.37	21.00		
14344	Wischer's Super. ...	Wischer and Co.	...	...	19.82	21.00		
14353	" No. 15 ...	" "	...	...	20.70	20.00		
14355	Wischer's Super. ..	" "	...	....	20.40	21.00		
14380	" ordinary	" "	...	...	21.05	21.00		
14295	" "	" "	...	...	21.72	21.00		
14504	" "	" "	...	...	21.80	21.00		
14490	" "	" "	...	...	20.89	21.00		
14507	" "	" "	...	..	21.43	21.00		
14501	" No. 15 ...	" "	...	...	19.87	20.00		
14517	Superphosphate ...	" "	..	...	19.00	20.00		
14524	" ...	" "	..	...	21.20	21.00		
14384	Wischer's Ordinary	" "	...	...	20.98	21.00		
14381	" No. 15 ...	" "	...	...	20.59	20.00		
14387	" Ordinary	" "	...	..	22.12	21.00		
14388	" No. 15 ...	" "	...	...	19.33	20.00		
14707	Grass Manure ...	" "	...	..	21.18	18.00	3.54	3.00
14735	Wischer's Ordinary	" "	...	...	20.02	21.00		
14739	" "	" "	...	...	21.11	21.00		
14528	" "	" "	...	...	21.74	21.00		
14704	" "	" "	...	...	21.34	21.00		
14705	" No. 15 ...	" "	...	..	21.14	20.00		
14350	Globe Super ...	J. Bell and Co.	...	...	18.38	18.45		
14272	" ...	" "	..	...	18.94	18.45		
14218	" ...	" "	...	...	19.22	18.45		
14480	Thomas' Phosphate	" "	...	...	15.42	16.60		
14487	Globe Super. ...	" "	...	...	18.98	18.45		
14494	" ...	" "	..	...	18.94	18.45		
14508	" ...	" "	...	...	19.32	18.45		
14357	Lascelles' Super. ...	Dennys, Lascelles, Austin and Co.	...	...	21.49	19.10		

A.—SAMPLES TAKEN BY OFFICERS OF THE DEPARTMENT—*continued.*

Sample No.	Brand of Manure.	Manufacturer or Importer.	Nitrogen.		Phosphoric Acid.		Potash.	
			Found	Guaranteed.	Found.	Guaranteed	Found.	Guaranteed.
14491	Lascelles' Super ...	Dennys, Lascelles, Austin and Co.	...	...	20.01	19.10		
14333	" " ..	" "	. .	...	19.20	19.10		
14358	Federal Super. ...	Australian Explosives and Chemical Co.	...	...	20.93	19.50		
14361	" " . .	" "	...	...	23.23	19.50		
14221	" Manure ...	" "	1.68	2.00	19.07	18.05		
14224	" Nitro Super.	" "	1.07	0.98	15.22	14.90		
14334A	" " "	" "	1.16	..	17.56	18.75		
14222	" Ordinary ...	" "	. .	...	20.48	19.50		
14223	" " 15%	" "	...	...	16.05	14.50		
14225	" " No. 1	" "	...	...	22.96	21.50		
14525	" " .	" "	...	..	21.06	19.50		
14736	" " . .	" "	...	..	22.10	19.50		
14693	" Manure ...	" "	0.96	1.40	15.64	13.50		
14497	" Super. ...	" "	...	...	20.06	19.50		
14503	" " No. 1	" "	...	...	22.78	21.00		
14694	" Manure ...	" "	...	...	14.91	13.00	6.35	4.00
14785	" Potato Manure	" "	0.07	..	21.75	17.50	3.68	3.20
14737	Nitro Super. ...	" "	1.03	0.98	17.11	14.50		
14733	Federal Super. No. 15	" "	..	..	17.74	20.00		
14738	" " "	" "	...	...	16.18	14.50		
14526	" " No. 1	" "	...	...	22.34	21.00		
14531	" " No. 15	" "	...	...	17.02	14.50		
14334	" Ordinary ...	" "	...	...	22.53	19.50		
14337	Crown Brand Super.	Dixon Bros. ...	0.94	0.86	16.92	18.95		
14774	" " Super. and Bone	" ...	1.50	0.86	20.77	18.95		
14696	Super and Bonedust	J. Cockbill ...	0.71	1.30	18.11	20.00		
14219	Bonedust ...	" ...	4.27	3.50	21.68	18.25		
14220	" ...	" ...	4.13	3.50	20.52	18.25		
14240	" ..	" ..	4.80	3.50	19.88	18.25		
14297	" ...	" ...	3.41	3.50	19.30	18.25		
14690	Superphosphate ...	" ...	..	...	18.93	19.00		
14498	36/38 % Super ...	W. P. Shaw ..	...	...	18.78	17.84		
14499	" . .	" ...	...	. .	19.00	17.84		
14520	Bonedust ...	P. Rohs ...	4.22	4.55	20.12	20.86		
14773	" ...	" ...	4.22	4.55	19.35	20.86		
14293	" ...	" ...	4.09	4.55	21.82	20.86		
14336	" ...	" ...	4.12	4.55	22.30	20.86		
14520	" ...	" ...	4.22	4.55	20.12	20.86		
14775	" . .	J. R. Ellsworth	4.13	3.00	21.18	19.00		
14691	" ...	A. E. Kleiner ...	3.92	3.24	23.23	20.95		
14276	" ...	Kensington M'f'g Works	3.55	3.50	20.31	19.52		
14780	" ...	" "	3.32	3.50	18.43	19.52		
14304	" ...	Waddell and Co.	3.30	3.00	16.30	17.00		
14273	" ...	Feore and Co. ...	2.83	2.43	16.89	17.69		
14771	" ...	J. R. Jopling ...	3.94	4.21	21.60	21.98		
14787	" ...	Eureka Bone Mills	4.40	3.00	19.35	19.00		

B.—SUPPLEMENTARY LIST OF MANURES ON THE MELBOURNE MARKET DURING THE 1905 SEASON.

Description of Manure.	Moisture. Per Cent.	Nitrogen. Per Cent.	Nitrogen. Estimated Value in One ton of the Manure. £ s. d.	Phosphoric Acid. Water Soluble. Per Cent.	Water Soluble. Estimated Value in One ton of the Manure. £ s. d.	Citrate Soluble. Per Cent.	Citrate Soluble. Estimated Value in One ton of the Manure. £ s. d.	Insoluble. Per Cent.	Insoluble. Estimated Value in One ton of the Manure. £ s. d.	Total. Per Cent.	Total. Estimated Value in One ton of the Manure. £ s. d	Where Obtainable.
Phosphoric—Readily Soluble.												
Superphosphate (S.)	11.28	..	..	20.45	5 7 4	0.66	0 3 0	..	..	21.11	5 10 4	Mt. Lyell M and R. Coy., Melbourne
„ (Hasell's) ..	11.06	..	..	20.53	5 7 9	0.94	0 4 4	..	..	21.47	5 12 1	A. H. Hasell, Queen-street, Melbourne
„	12.93	..	..	19.47	5 2 3	0.76	0 3 6	..	..	20.23	5 5 9	„ „
„ (Nitro)	13.49	..	..	16.32	4 5 8	1.95	0 9 1	0.35	0 0 4	18.62	4 15 1	Mt. Lyell M. and R. Coy., Melbourne
„ (Bonedust) ..	7.13	..	..	11.27	2 19 3	3.78	0 17 0	4.23	0 4 3	19.33	3 10 6	P. M. Metzler. Nicholson-st., Fitzroy
Phosphoric—Difficultly Soluble.												
Bonedust	18.01	2.45	1 3 3	..	..	..	..	..	..	16.28	2 15 6	H. J. Feore and Coy., Lord-st., Richmond
„	9.07	4.41	2 1 10	..	..	..	..	..	..	19.46	3 11 9	J. A Kitchen and Sons, Flinders-st., Melbourne
Digester Refuse	6.59	2.03	0 19 3	..	..	..	..	..	..	30.59	4 11 9	W. H Taylor. Little Collins-st, Melbourne
Imperial Blood and Bone Manure	12.73	4.90	2 6 6	..	..	..	..	..	..	16.99	3 2 9	W Angliss and Co., Footscray.
Animal Fertilizer	10.89	6.35	3 0 3	..	..	..	..	..	..	12.81	2 15 9	Newport Freezing Works, Melbourne
Mixed Manures, containing Phosphoric Acid, Nitrogen, and Potash.												
Grain Manure	10.51	0.51	0 7 6	9.18	2 8 2	2.24	0 10 5	..	..	11.42	2 18 7	P. M Metzler, Nicholson-st, Fitzroy
Rape „	8.89	0.04	0 0 7	13.48	3 10 9	1.87	0 8 8	..	..	15.35	3 19 5	„ „ „
Lucerne „	8.47	0.05	0 0 5	10.54	2 15 4	1.65	0 7 8	..	..	12.19	3 3 0	„ „ „
Potato, Mangel, and Vegetable Manure	10.89	1.59	0 17 6	8.01	2 2 0	1.79	0 8 4	..	..	9.80	2 10 4	„ „ „
Potato Manure	9.33	1.08	0 15 6	16.48	4 6 6	1.26	0 5 10	..	..	17.74	4 12 4	Mt. Lyell M & R. Coy., Melbourne
Orchard „	9.68	1.75	0 5 0	14.63	3 16 9	1.14	0 5 3	1.09	0 3 0	16.86	4 5 0	„ „ „

B.—SUPPLEMENTARY LIST OF MANURES ON THE MELBOURNE MARKET DURING THE 1905 SEASON—*continued.*

Description of Manure.	Potash.		Mechanical Condition.						Estimated Total Value of Manure per To	Price asked for Manure per Ton *	Where Obtainable.
	Per Cent.	Estimated Value in One ton of the Manure.	Per Cent. of Fine Bone.	Per Cent of Coarse Bone.	Nitrogen. Per Cent. in Fine Bone.	Nitrogen. Per Cent in Coarse Bone.	Phosphoric Acid. Per Cent. in Fine Bone.	Phosphoric Acid. Per Cent. in Coarse Bone.			
		£ s. d.							£ s. d.	£ s. d.	
Phosphoric—Readily Soluble,											
Superphosphate (S.)	..	..	..	..	..	..	..	..	5 10 4	4 15 0	Mt. Lyell M. and R. Coy., Melbourne
„ (Hasell's) ..	..	..	..	..	..	..	..	..	5 12 1	4 7 6	A. H Hasell, Queen-st, Melbourne
„	..	..	..	..	..	..	..	..	5 5 9	4 10 0	„ „ „
„ (Nitro)	..	..	..	..	..	..	..	..	5 13 4	5 0 0	Mt. Lyell M. and R. Coy., „
„ (Bonedust) ..	..	..	..	..	..	..	..	..	4 6 8	5 5 0	P. M. Metzler, Nicholson-st., Fitzroy
Phosphoric—Difficultly Soluble.											
Bonedust	..	..	26.98	73.02	0 67	1.78	4.00	12.28	3 18 9	5 5 0	H. J. Feore and Coy., Lord-st., Richmond
„	..	..	41.42	58.58	1.82	2.59	8 06	11.40	5 13 8	5 10 0	J A. Kitchen and Sons, Flinders-st, Melbourne
Digester Refuse	..	..	..	..	..	2.03	..	30.59	5 11 0	6 0 0	W H Taylor, Little Collins-st., Melbourne
Imperial Blood and Bone Manure	..	..	39.24	60.76	1.62	3.28	7.08	9.91	5 9 3	6 0 0	W. Angliss and Co., Footscray
Animal Fertilizer	..	..	19.04	80.96	1.15	2.40	5.20	10.41	5 16 0	5 10 0	Newport Freezing Works, Melbourne
Mixed Manures, containing Phosphoric Acid, Nitrogen, and Potash.											
Grain Manure	1.49	0 8 2	..	..	..	..	..	..	5 14 3	5 10 0	P. M. Metzler, Nicholson-st., Fitzroy
Rape „	0.65	0 3 9	..	..	..	..	..	..	4 3 9	6 0 0	„ „ „
Lucerne „	2 00	0 11 0	..	..	..	..	..	..	3 14 5	5 10 0	„ „ „
Potato, Mangel, and Vegetable Manure	4.00	1 2 0	..	..	..	..	..	..	4 9 8	6 0 0	„ „ „
Potato Manure	4.02	1 2 1	..	..	..	..	..	..	6 9 11	6 0 0	Mt. Lyell M. & R. Coy., Melbourne
Orchard „	5.35	1 9 5	..	..	..	..	..	..	6 19 5	7 0 0	„ „ „

* Price asked for delivery at local railway station.

The tables on this and the preceding page refer to the same samples of manures.

Flower Garden.

The cold and generally unseasonable weather experienced during spring, followed by an unprecedented invasion of thrips, provided what have probably been the most unfavorable conditions ever experienced by rose growers in this State during the all-important spring flowering season. Practically roses have been a decided disappointment, particularly from an exhibitor's point of view. Dark coloured decorative varieties and most of the single kinds, have been fairly satisfactory, making a fair show in the gardens. Many first-class blooms, of varieties of the dark hybrid perpetual and hybrid tea sections, have been grown, but a number of the most generally reliable kinds have not produced a single good bloom, although most promising prior to the occurrence of the thrips on November 6th. The varieties illustrated are (1) "Belle Siebrecht," syn. "Mrs. W. J. Grant," hybrid tea, rose pink in colour, and one of the best roses either for garden or exhibition; a climbing sport has been "fixed" and distributed, and is to be preferred to the dwarf variety; (2) "Ards Rover," hybrid perpetual, is also a climbing rose, deep crimson in colour, a splendid spring blooming kind; and (3) "Marquise de Salisbury" hybrid tea, brilliant red, and one of the best roses for massing. The blooms are simply decorative.

Established roses should not be unduly excited during this month by heavy waterings in hot weather, but should be allowed to rest, in a measure, preparatory to the pruning and feeding for the autumn blooming. Of course no plant should be allowed to suffer to such an extent as to lose any of its foliage; and plants set out last season will need watering during dry hot weather.

Early-planted dahlias will now be well advanced, and will need to be securely tied to stakes or other supports, and be well supplied with water.

Where a sprinkler can be used, a thorough overhead watering during dry hot weather, is most beneficial. This watering should be applied in the evening. If the plants are kept moist, there is not much liability to attacks of red spider, as this pest thrives under dry conditions. When once the plants are attacked, it is a very difficult matter to eradicate them. The formation of flower buds will cause the development of lateral shoots along the main stems. If large blooms are desired, remove these laterals to within a foot of the ground, and thin out the flower buds also. After the early blooms are past the shoots that were allowed to remain on the stems will make good growth, and produce fine flowers later if the old shoots that have bloomed are cut away, and the new ones tied in their stead, and treated as the first. A light dressing of Peruvian guano, lightly forked into the soil under the mulch, will greatly assist the plants. This should be mixed with dry earth, very lightly scattered, and worked into the soil at a distance of about 18 inches from the stem. It must be remembered that this is the most stimulating of all animal manures, and must be used cautiously, or harm will result. Three cwt. of Peruvian guano is considered equal to 20 tons of stable manure. After applying the manure, a thorough watering is necessary. Dahlias planted late in December, to bloom during March and April, should be mulched about the end of January. If intended for exhibition, the plants should be pinched and induced to produce about six or eight strong shoots, which should be securely tied to a stake as growth advances, and kept well supplied with water. The soil should be lightly stirred occasionally.

Chrysanthemums, grown for exhibition, should not be allowed to receive any check during this period of their growth. The "break" or run of growth now being produced will provide the "crown" buds during February, from which the finest blooms develop. The character and value of the flowers depend altogether on these growths and their condition. They should be securely (*not tightly*) tied to stakes, and kept growing steadily. The beds should be occasionally hoed lightly, and sucker growths removed, and sufficient water applied during dry hot weather to keep plants from flagging. No feeding with liquid manure should be attempted in the open ground at this juncture. Plants grown in pots require such feeding as soon as their roots reach the sides of the pots, but it should be applied very weak at first. When Cannas have flowered, the old flower shoots should be entirely cut away. A top dressing of manure, and a thorough watering will assist in the production of a number of new shoots that will bloom in late summer and autumn, when the weather is cooler and moister. Delphiniums should also be cut down after flowering. A fresh break into growth will occur in a few days, and a good flowering will follow in about six weeks.

Seeds of perennial plants may be sown. A position sheltered from rough winds should be selected, and the seeds sown in boxes or beds that can be easily shaded, if necessary, and thoroughly watered. Something in the way of the roller blinds, which may be seen at any nursery, is suitable for shading. The material may be hessian or calico. To get the best results, new fresh seed, and a fair amount of heat and moisture are necessary. January is the best time to sow seeds of pansy, Iceland poppy, and other plants for blooming during the winter.

Ground should now be prepared for the reception of spring-flowering bulbous plants, bulbs of which may be procured during the next three months. As previously advised, the soil should be well and deeply worked, and some well rotted manure incorporated.

Kitchen Garden.

The abundant rain at the beginning of last month should insure a fair supply of most vegetables during summer, where sufficient plants were raised to plant out, and advantage was taken of the favorable conditions for planting. Cabbage, celery, and other vegetables, once fairly established, endure a deal of heat and drought, if the soil is regularly stirred and moisture conserved.

Seeds of cabbage and cauliflower (early varieties) may be sown, and plantings made from former sowings, allowing fair room for the plants to develop. Seeds of kidney beans and early varieties of peas should be sown in drills. The soil, if dry, should receive a good soaking before the seeds are sown. "Daisy" is a good early variety of pea, a very dwarf grower, and splendid cropper. Enough seed of turnip, early carrot, radish, and other vegetables should be sown to meet requirements. Tomato plants should be tied to stakes as they advance in growth, and all laterals removed from the selected shoot, or shoots, as they appear. Where heavy crops are set, abundant watering and mulching are necessary to assist the plants to properly mature the fruit.

Ground should be deeply worked and well manured for the reception of autumn crops. Early varieties of potatoes may be planted. In connexion with potatoes, it may be interesting to note that two of the varieties recently introduced by the Department of Agriculture, viz., "The Factor" and "Up-to-Date," are, in England, considered to be among the six best flavoured varieties. "Langworthy," another variety that has been imported, is also included, but is stated to be a light cropper.

ROSES.

C. French, F.L.S., F.E.S., Government Entomologist.

Notes for Beginners.

Position.

The most necessary of all conditions for rose growing are position, soil, and shelter. I allude to shelter without shade, that is, a hedge of some material which does not impoverish the soil, as privet, pittosporum, &c., which will afford the necessary shelter without too much shade. Where it is inconvenient to plant hedges, shelters made of tea-tree will answer as well as most things. For position, choose, if possible, a site facing the north-east, and at once commence the very important task of forming your rosary.

Soils and their Preparation.

To use the words of the Rev. Mr. Dombrain, of rose-growing fame, the soil should be a rich unctuous loam, a loam which when pressed between the finger and thumb does not crumble, but kneads like a piece of putty; it must not be clay, although approaching it closely. Here is the experience of one of our oldest and best growers, and, as I have ofttimes tested it for myself, I can vouch for its accuracy, and the practical nature of the advice given. "In preparing the beds, we measured a space 4 feet for the first trench, all subsequent trenches being of the same width; this afforded plenty of space for getting sods, manure, &c., in evenly. The top spit, which consisted of good old fibrous turf, was then wheeled to the farther end of the bed, and kept separate on one side; also the next spit below, so as to be at hand for filling up the trench. The bottom spit was taken away as useless, leaving a trench 2 feet 6 inches deep. This was filled in the following manner:—At the bottom was placed a layer of yellow clay some inches deep, so as to retain moisture (the sub-soil being gravel), and on this a layer of small chalk (our marl would do). Thus about half the sods which constituted the first spit of the next trench were placed turf downward, and loosely broken up smaller. Then the first sods were covered with cow manure, and finally filled up with the second spit of the following trench." There are other ways of preparing land for roses, but the trenching and draining must be insisted upon. It is a long-standing and a popular error that roses will not do well in sand, and must have clay. This is a mistake, as some of the best stands of roses ever seen in the State were, in the early sixties, grown on a sand-hill with an exposed south-west aspect. I do not, of course, advocate sand for roses, but merely wish to show that roses will grow and thrive in sand, but blooms grown on sand lack the solidity and lasting qualities of those grown on heavier soils.

How and When to Plant.

Having selected your site and soil, you will now have to select your time for planting, and upon this subject there is a great diversity of opinion. In a normal season I prefer the end of May to remove and plant standards, and dwarfs from May till October. Pot-grown plants of both standards and dwarfs may, of course, be planted at any time. When a garden has to be made late on in the season, the pot-grown stuff is a decided advantage; if carefully planted they will hardly feel the shifting. In selecting standards, choose straight green and healthy-looking stems, with ripe and vigorous growth forming the heads of the plants in question. In planting a rosary, I prefer the half-standards, as they offer less resistance to the wind, and, as a rule, do better than the taller plants. In sheltered spots, and to take off the squat appearance of a group, the full standards may be used with advantage. In planting roses, see that the roots are well spread out, and trodden firmly in after planting. This will be especially necessary when planting full standards. Staking at once is the safest and best plan to be adopted, and in exposed places a warp of hayband is a good help in preventing the stems from being scorched by the sun. The question of roses grown on their own roots, *i.e.*, struck from cuttings and not worked, and those worked upon other stocks, has long been a much-debated question. For a bush garden, that is, where display alone is required, and but little

display of symmetry is practised, I certainly prefer the great majority being on their own roots, as they make bigger shrubs, and are, upon the whole, more hardy. When suckers appear they are those of the parent plant, and have not, as is the case of worked plants, to be removed. There are, of course, some kinds which do better when worked on a vigorous stock, but in so short an article as this the matter cannot be properly explained.

PRUNING.

As with fruit trees, there is no royal road to pruning, as different varieties often require different treatment. One good rule is, not to be afraid to trust an experienced hand with a pruning knife. The beginner would do well to take a lesson or two from some practical and well-known rose grower. There are some roses which will not grow unless cut hard back, while others do not thrive when so treated. It is a common error that rose-growing is difficult to learn. This is not so, and, strange as it may appear, it is easier to grow a rose by ordinary means than to kill it, excessive wet and absence of drainage being the two conditions fatal to rose culture.

SELECTION.

This is a wide field, and must be left largely to the man of experience, especially Australian experience, as roses which are in the first rank in Europe are not always so in Australia. There are a few rules which, as one of the pioneer rose growers of the State, I may commend to your consideration. First, deal from recognised firms of nurserymen; second, purchase the best stuff; and lastly, but not least, do not purchase at auction. These plants frequently have their labels knocked off by removal, and are often allowed to remain too long exposed to the sun and cutting winds. As to the varieties to plant, you cannot do better than consult the lists published from time to time by the National Rose Society of Victoria, and other publications issued in the State.

Insect Enemies of the Rose.

The rapid strides made during the past few years in the hybridization of the "Queen of Flowers," and the extraordinary prevalence of insect attack, renders it imperative that some practical means for dealing with the latter should be forthcoming. From a long experience I can with safety deal with the matter through the columns of the Victorian *Journal of Agriculture*. I have therefore given a short account of the life-history of the insects herein treated, with some suggestions as to the means to be adopted for prevention and eradication.

THRIPS.

The eggs of the Thrips are deposited upon plants of various kinds, the pupa being not unlike the insect when in its perfect state. It is marvellous with what rapidity these tiny insects increase, a part cause, according to the testimony of Dr. Howard, Chief of the Entomological Division of the United States Agricultural Department, being the presence of that singular character known as parthenogenesis. Thrips are a perfect terror to gardeners, especially when plants are out of doors. Fumigation and moisture when under glass render successful treatment easier than in the case of plants grown in the open.

When the spring buds make their appearance, keep the spray pump going. Use a weak nicotine mixture, also extract of quassia, pyrethrum, or anything else which would likely act as a deterrent. Once the thrips penetrate the buds, no matter how small the latter may be, the damage has commenced. When roses are badly attacked by thrips, all infested blooms and buds should be carefully removed and burnt, and a good spraying with nicotine should be at once given. If good autumn blooms be desired, cut the roses lightly back, and as the normal summer advances the thrips will disappear, and there will still be a chance of fairly good summer blooms. It is noticeable that during the last and present seasons especially, the tea and hybrid tea sections have been the worst sufferers, our favorites "Maman Cochet" and its relations having had a sorry time of it. The hybrid perpetuals, also some of the looser petalled kinds, as "Lady Battersea," "Liberty," "Grus au Teplitz," and others have, in most places at least, been practically free from attack.

Some writers recommend the use of a board on which honey, or some other sticky substance, has been placed. This is held over the plants affected, and the plants are then shaken, when clouds of the thrips fly upward, and are thus captured in enormous numbers. Unfortunately, the thrips are by no means confined to the rose, as they will tackle most plants, and are very destructive to early blooming apples, raspberries, &c. This tiny insect is also one of the very worst pests of the azalea grower. There are a large number of species, which are generally distributed throughout the habitable regions of the globe. When mulching, roses especially, use the best rotted manure, and not fresh stable dung.

ROSE APHIS (SIPHONOPHORA ROSÆ).

These are small green or reddish plant lice living on the stems and young leaves of the rose, which they puncture with their beaks, and extract the sap, thereby causing the leaves to shrivel, turn black, and finally injure the young buds of the plant. The wingless insects are mostly green in colour, but sometimes reddish. The winged lice are green, the head and thorax brown or black, the abdomen marked with black or brown. We all know of this troublesome pest of the rose-grower, and have, doubtless, had many a fight with it. There is but one practical way of dealing with the rose aphis, and that is to keep working away with your spray pump, never resting so long as any traces of the insects are visible. As to the remedies to be used, I wish to state that I am simply giving you the results of my own observations, so that I do not wish to discredit, or in any way belittle what others have done, and are doing, towards the suppression of the aphis in question. Immediately after pruning, spray with a weak (1 in 15 or 20) kerosene emulsion. Later, when the buds are showing signs of breaking, again spray with a weak decoction of quassia chips. This renders, for a time, at least, the bark distasteful to the aphids about to puncture. When the shoots are becoming firm spray with either soaperine, nicotine, Garrick's emulsion, or Girhurst compound. (I prefer the emulsions and nicotine, which do not require washing off with water.) The price of success is constant vigilance, but it must be borne carefully in mind that the young foliage of all roses is most tender, and easily injured by strong applications, which, owing to the rapid increase of the insects in question, must, after all, be applied to the plants several times. Aphids are great disfigurers of the rose, and should be tackled by all lovers of our favorite flower.

(*The conclusion of this article will appear in the February Number of the Journal.*)

MODERN BEE FARMING.

R. Beuhne, President Victorian Apiarists' Association.

PART IV.—THE BEES.

There are several ways of stocking an apiary with bees. Which of these is adopted must depend upon the means of the intending apiarist, the degree of knowledge he possesses, and the circumstances of locality and season.

A SWARM OF ITALIAN BEES.

The easiest but most expensive way is to buy established colonies in hives of the pattern one intends to adopt. There are many badly kept hives all over the country, and it is usually such that are for sale. Although the hives and frames may be factory made, the combs are often badly built, joined together, or largely composed of drone comb. There is also the risk of disease in the combs. It is therefore best to obtain established colonies from some one who makes the sale of bees part of his business. The price for a colony of bees in a two-story hive, with

drawn or partly-drawn combs, ranges from £2 upwards, according to strength of the colony, time of year, and the law of supply and demand. Another way of starting is to buy three-frame nuclei, that is, three frames of comb, bees—queen and some stores—from a supply dealer or apiarist. The bees and frames are on arrival transferred to a single-story hive, combs, or frames with foundation, added to fill the box. The transit nucleus-box is usually returned to the supplier. These nuclei, if obtained in October or November, will, under favorable conditions of season, rapidly work up into good colonies. The price, governed by the same circumstances as in the case of colonies, is from 10s. upwards.

Bees may also be bought in common box hives and transferred to frame hives. There is in this, however, even greater risk of introducing foul brood than in the case of neglected frame hives. Years ago it was a common practice to transfer not only the bees, but also the larger amount of comb, with brood and stores. This was accomplished by cutting the straighter combs to fit into frames, temporarily securing them in position by means of string or small sticks, and giving them back to the bees in their new hive. It is at best a laborious and unsatisfactory work, and the resulting combs are not what are expected in a frame hive. Owing to the additional drawback of also occasionally transferring disease to the new hive, the practice has been largely abandoned in favour of another method, which transfers all the bees to the new hive, even those still in the larvæ stage, without transferring combs and carrying infection.

The method is easiest during the swarming season, but may with certain modification be carried out at any favorable time during bee activity. Having purchased a number of box hives, say, 20. in spring, place them on the exact spots where you wish your frame hives to stand later on. At the beginning of the swarming season, we will assume that 10 of the 20 are strong, that 5 are medium, and 5 weak. We will name them A, B, and C respectively. If one of the A swarms, secure the swarm in a common box, as much like the one the swarm came from as possible. When the swarm has calmed down somewhat (in half-an-hour to an hour), take the box it came from away, and stand it close alongside one of the C hives. Then bring the box with the swarm back to the place formerly occupied by its old home, facing in the same direction. During the day any field bees which remained in the box when the swarm issued, or were away foraging, will fly to their old locality, and thus join the swarm. About sunset on the following day the new bar-frame hive is put in place of the box hive; the swarm is dumped out on to a cloth or bag spread out in front of the entrance, and the bees allowed to run in. Provide plenty of ingress by raising the hive somewhat off the stand in front.

In the parent box from which the swarm issued, and which stands now alongside one of the C hives, all the worker bees will have hatched out 21 days after the swarm left. A young queen will begin to lay in from 16 to 20 days. Therefore, on the 22nd day, if the bees are drummed up into an empty box in the usual way as when box-hives are robbed, there will be nothing in the brood combs but eggs, some very young larvæ, and possibly a little unhatched drone brood. The combs may then be boiled down for wax, and the bees started in a frame hive. The C hive close alongside is drummed up at the same time and put into a frame hive. The box, with combs of brood, is carried away and put on

top of one of the B hives; through the top of which some 1-in. holes have been bored with a centre-bit to allow the bees to come up and take care of the brood. If pieces of queen-excluding zinc are placed over the holes, the queen is kept below, and in 21 days the bees may be drummed out of both boxes, put on frames, the top box combs boiled down, and the lower box, with the brood, carried away and put on top of a B or C hive. This may be repeated till there is but one box hive left, which, if it does not swarm, has to be treated as in robbing box hives.

We must here refer to the parent stock of the first swarm, and the C hive it was placed alongside of, each of which is now in frames and close alongside each other. A few days after it is transferred the C hive should be looked through for the queen, which is to be destroyed. At dusk the same, or the following day, both hives are shifted aside. One hive is placed exactly on the centre line where the two stood, and in it are placed the combs and bees from both, alternating them and blowing smoke between all the time. The remaining hive body is put on top as a second story, if required. We have now a normal colony, with a good young queen.

In seasons when there is not enough swarming, or after the swarming season, one-half of the box hives to be transferred may be drummed out and put in frame hives at once. Put the boxes of brood on the remaining ones. In three weeks this may be repeated. It should, however, be borne in mind that transferring should not be done unless the weather is warm, and there is a fair income of honey; also that a weak colony cannot take care of the brood from a strong one, but a weak one may manage the brood of a medium, and a medium that from a strong one. This holds good also in regard to bees in frames; any strengthening of the weaker colonies by means of combs of brood from the stronger should be done gradually, otherwise much of the brood transferred will be wasted, although this will only be noticed by a careful observer.

There is yet another way of obtaining bees, namely, by live weight—that is, purchasing the bees at so much a pound, 2s. 6d. a pound being about an average price in spring. A swarm of black bees will weigh from 3 to 6 pounds. Swarms of hybrids and Italian are often much larger, up to 12 pounds being known. The swarm in the accompanying illustration, after being hived, was weighed, and gave a net weight of bees of 10½ pounds. If swarms are sent any distance there is considerable risk of loss from overheating, unless the transit boxes are of sufficient size and properly constructed. For a 4-pound swarm the box should be about the size of a kerosene case, with a frame of 1in. by ½in. wood, covered on the inside with fine wire screen at each end in place of the end boards of the case, so that no matter in what position the box stands there is always thorough ventilation. The projecting upper and lower cross-pieces of the ends prevent close fitting up against any flat surface during transit. The inside of the box should be rough, as the bees cannot retain their foothold on planed boards, in case of jars and knocks in transit. If sent by rail mark the boxes, "Keep in the shade and well aired." On arrival at the apiary, the boxes are best kept in a cool, draughty place, and the bees run into their hives about sunset, otherwise there may be much confusion and some swarming out; whereas, if released in the evening, the bees will have calmed down, and will locate their new surroundings as they commence to fly.

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NHILL FARM COMPETITIONS.

Report by W. Gamble.

The Best Farm exceeding 640 Acres.

The points fixed by your Society and submitted to me to work on are as follow:—

	Points.
(A) The best system of cultivation, rotation, &c., pursued on each farm inspected	15
(B) The best system of manuring the land, names of manures, and quantities used per acre	10
(C) The best system of saving stable and other manures on each farm	5
(D) The best and cleanest growing crop	10
(E) The best system of fallowing and working of fallow ...	15
(F) The best and most profitable classes of live stock kept on each farm	15
(G) The best implements and machinery kept and used on each farm	20
(H) The condition and system of fencing	10
(I) The best kept kitchen garden and orchard	10
(J) The best provision for water supply	30
(K) Best arrangement and system of dwelling and farm building	20
Total	160

There are six competitors in this section, and it is only after the most careful and thorough investigation into all the details that I have arrived at the results as placed before you. I may state that I will be pleased to give my reasons to any of the competitors, as to how points were given in any particular item. This is only fair, as the competition is held for the purpose of education and improvement in agricultural pursuits, and when a competitor knows the reason why a judge lops off points in a particular direction he may be able to remedy the deficiency on some other occasions.

The following are the results:—

Name.	A	B	C	D	E	F	G	H	I	J	K	Total.
Maximum points ...	15	10	5	10	15	15	20	10	10	30	20	160
Geo. Batson	14	8	4	8	12	12	18	4	10	22	10	122
W. Sanders ...	12	8	2	6	8	14	19	5	8	26	12	120
J. Dufty and Sons ...	12	8	1	6	11	14	17	5	7	22	16	119
O. H. Roediger ...	12	7	1	4	11	10	12	5	7	26	20	115
Geo. Crouch ...	14	8	1	9	10	12	14	5	4	21	10	108
John Bond ...	12	7	1	5	8	14	12	5	4	22	10	100

Thus it will be seen that Mr. G. Batson, of Haycroft, is first with a total of 122 points; Mr. W. Sanders second with a total of 120 points; and Messrs. John Dufty and Sons third with 119 points.

The closeness to which the points total indicates the extreme difficulty in arriving at a definite conclusion.

JUDGING MR. BATSON'S CROP FOR WEEDS.

The points laid down by the Society answer the purpose for which they were intended admirably. One small addition might be made with advantage; that is, points to be allowed for experimental work. With the great variations in the different soils it is necessary that every farmer should carry out experimental work on his farm according to the means at his hands; not only to find out the nature of his land, but also to know what plants are suitable to that particular soil. Where horses and machinery are available it does not entail a great deal of time and labour. Then, again, on most of the large farms the farmers' sons do the work, and experimental work is not only interesting, but has a good educational influence on lads who will naturally follow in the footsteps of their fathers, and although many farmers have succeeded and become prosperous, they feel that had experimental work been carried out by them, many losses sustained would have been averted.

It may be of interest to make a few notes on two or three of the highest points obtained in each item.

(A) THE BEST SYSTEM OF CULTIVATION, ROTATION, ETC., PURSUED ON EACH FARM INSPECTED.

The points in this item run out very evenly, as the farms visited have all adopted an up-to-date system of cultivation and rotation, viz.—fallowing the land deeply and well, pulverizing the soil during the spring and early summer to kill all weeds, &c., and also to conserve moisture for the coming crop. The rotation is carried out by growing a wheat crop, followed by oats, then grazing for two or three years. I find Mr. Batson has worked in barley and rape as rotations, and has also sown Italian rye grass on several wheat fields to provide a variety of feed for sheep amongst the stubble, and an early green bite after the first autumn rains. Mr. Crouch works his rotation much the same as above, and gives special attention to his fallow, which was in perfect condition; his crops also show the effect of good cultivation. These two competitors have received the highest number of points in (A).

(B) THE BEST SYSTEM OF MANURING THE LAND, NAMES OF MANURES, AND QUANTITIES USED PER ACRE.

The points obtained are evenly distributed, as the general method is to apply phosphate manures by means of the drill at rates varying from 40 lbs. to 56 lbs. per acre. On one farm I noticed a strip that was left unmanured the width of a drill and a few chains long, and the effect was remarkable, a difference of two or three bags per acre. The application of stable manure to the poor and sick patches of land has proved very beneficial, and should be generally adopted on all farms in the Wimmera, as it is these patches of hungry land that reduce the average yield of a paddock, and again these patches appear to facilitate the growth of weeds, such as the white everlasting. It was very interesting to know that farmyard manure when properly applied has a good effect, as the experience in some of the dry districts was that farm-yard manure left no manurial effect on the yield. From information gathered the best results are obtained from applying the manure directly before fallowing and ploughing it under.

(C) THE BEST SYSTEM OF SAVING STABLE AND OTHER MANURE ON EACH FARM.

In all cases but one the manure was simply carted from the stable and tipped into a heap to be scattered about by the fowls, wind, &c. Some of it is saved certainly, but it is not done systematically. Mr. Batson here stood out alone as being the only one who attempted to save his manure, so that the full advantage of manurial effects was given to the land on which it is applied. A glance at the neatly trimmed, squarely built, heap of well-rotted manure showed at once that the owner placed a high value on the refuse of the farm. In hot dry climates, such as the Wimmera, the pit system of saving manure is preferred. This can be made cheaply, and would repay well the outlay by saving extra waste, and also assisting the decomposition by retaining the moisture throughout the summer.

(D) THE BEST AND CLEANEST GROWING CROP.

The crops on the whole were good, the fallow paddocks showing out distinctly against those ploughed in on stubble, again demonstrating that fallowing, combined with the drill and phosphatic manuring, is the only sure way to obtain a good clean crop. In spite of the careful cultivation, eating down with sheep, &c., a sprinkling of wild oats can be seen nearly everywhere. These may have their advantages providing a farmer can keep them sufficiently under control to grow a fairly clean crop for two succeeding years; for with the advanced methods of combining sheep and wheat growing, the farmer must keep in view the provision of feed for his sheep, and as wild oats thrive naturally on the dark lands of the Wimmera, where the natural grasses do not adapt themselves very readily

MR. G. CROUCH'S 180-ACRE PADDOCK OF WHEAT.

after cultivation, the farmer is forced to admit that good provender is provided where it otherwise would be almost bare of vegetation. In wheat crops Mr. Dufty has carried out an experiment worthy of notice on a 160-acre paddock. The land is of a sandy loam nature, and has grown a crop of wheat for six successive years—each year the returns were good. This season a crop of wheat will give a return of about 1½ tons per acre of good clean wheaten hay. I merely mention the above as an experiment, but would not approve of the system of continuous cropping, as it exhausts the land to such an extent that it takes years to recover again. Mr. Crouch gains highest points in this item, his crops right through were good. A small lot of Calcutta oats had a fine appearance, the ears being long and heavy. More attention might be given to this oat on account of the feeding value of the straw, which is sweet and greatly relished by stock, and would serve well as a stand-by in years of drought. Mr. Batson's 100-acre paddock of Algerian oats was the best I saw in my travels; his wheat and barley also looked well.

(E) THE BEST SYSTEM OF FALLOWING AND WORKING OF FALLOW.

This is rather a difficult one to determine on points, as the farms extend over an area of about 50 miles of country, the land varies considerably, and what would be considered a good ploughing in one is the reverse in

another. In one district 6 inches deep may be turned over with advantage, while in another district $4\frac{1}{2}$ inches is deep enough on account of the raw crude clay underneath. Then again mallee land does not require the after working that the heavy black land gets with success. The great object is to conserve moisture, and with a fine tilth on the surface a greater amount of moisture is retained. There is one particular point that all were unanimous on, *i.e.*, "that the fallow must not be deeply worked during the hot summer months, but a light surface harrowing should be given occasionally." I may state that on all the farms visited the fallow land was in good condition, showing that the farmers are bringing to bear the results of past experience with great force, and I trust will keep on improving their methods.

(F) THE BEST AND MOST PROFITABLE CLASSES OF STOCK KEPT ON EACH FARM.

I was surprised to find the excellence of the stock on most of the farms, Messrs. Dufty and Sons, and Sanders especially—the former with their

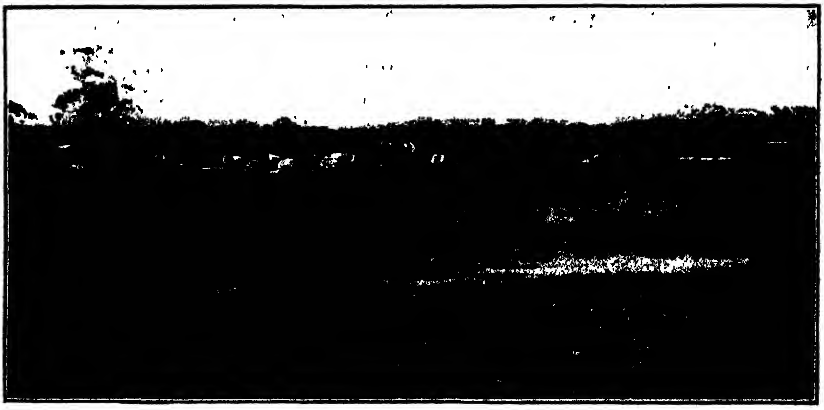
MR. W. SANDERS' HIGH-CLASS MERINOS.

well-set Clydesdales, and the latter with his high-class sheep. These gentlemen deserve great credit for the way in which they have brought their stock to the pitch of excellence, and it is a boon to a district to have such men to provide studs for the surrounding country. Mr. Bond also has the nucleus of a very useful sheep for the present day, "Shropshires," and has raised the standard of his flock considerably by selection and judgment. In giving points for stock, I have considered them as a whole, and it is this that has brought up the points of other competitors, although I admit that horses and sheep are the two main classes of stock for profit in the Wimmera, but to make farming a profitable industry it must be mixed, and to those who have laid themselves out to raise cattle, pigs, and poultry, I cannot help giving them due credit by the way of points. Poultry, though despised a good deal in the past, is making rapid strides as a profitable adjunct to the farm, and when a farmer with a

family tells me that the returns from his poultry have covered all his expenses at the general store it is high time attention should be given to this industry. The Wimmera appears to suit the rearing of poultry, as those seen by me were both healthy and robust. With cheaper freights and a better system of transporting the live stock long distances, such as from Nhill to Melbourne, I am quite sure farmers will give poultry greater attention.

(G) THE BEST IMPLEMENTS AND MACHINERY ON EACH FARM.

The implements and machinery were up to date according to the requirements of each farm. It depends on the area cultivated as to what machinery is required, harvesters being the latest improvement, were given points in preference over strippers. One machine I would like to see used more extensively is the seed grader. There is no doubt that by grading seed, the quality of the crop generally is improved, the plants being more "even," robust, and healthy. It consequently gives better returns.



MR. SANDERS' IMPLEMENTS AND MACHINERY.

Grading machines on the market might be improved considerably. I noticed the scarifier-tyne harrow is being generally used in breaking down fallow to a fine tilth. This implement does its work well and is to be recommended.

(H) THE CONDITION AND SYSTEM OF FENCING.

The fences in all cases were posts and wire in fairly good repair, and as the old fences become dilapidated they are replaced by new ones with a barb and 5-wire. This makes a good substantial fence. In giving points I took gates into consideration. A gate in good repair is an acquisition on a farm, it saves time, labour and often needless expense, especially when barb wire entanglements are hung as a trap for some valuable animal to be caught in, and severely lacerated. I would advise others to note the new gate Messrs. Dufty and Sons are adopting on their farm. It is cheap, easily and quickly made, serviceable and durable. Good fences and good gates well hung give to a farm a good appearance.

(I) THE BEST KEPT KITCHEN GARDEN AND ORCHARD.

You will notice the points vary in this considerably. In allotting points I have taken into consideration—(1st) The usefulness of the whole garden

in providing fruit and vegetables for the family table; (2nd) the manner in which it is laid out, cultivated and kept; (3rd) its appearance in enhancing the beauty of the homestead. I have given full points to Mr. Batson, as he has a variety of fruits in the orchard, grapes in the vineyard, and a good collection of the different varieties of vegetables; I might state that he is the only farmer in this section who has made provision for a good supply during the summer months in a systematic way, which is important. The old winter and spring bed was just about finished, but in another large bed, long rows of fine healthy vegetables were coming on for the harvest time, when they are most required, and are appreciated to a greater extent when taken fresh from the garden. This garden was well cared for both in cultivation and pruning. In the front of the house flowers flourished with creepers climbing over and around the old home, with here and there trees and shrubs as shelter.

MR. G. BATSON'S VEGETABLE GARDEN.

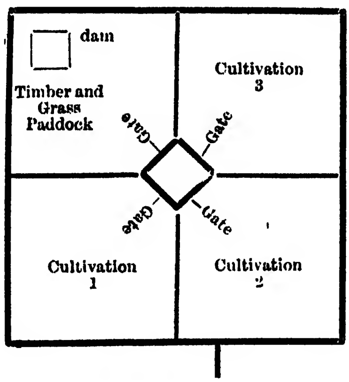
I would like to say a few words in praise of Mr. Roediger's beautiful flower garden and fernery. It takes a good deal of imagination to think that away on the border of the "Mallee," such a garden can exist, and had I not seen it with my own eyes would not have believed it. It is an object lesson to others what may be accomplished with water in such a climate, and also the possibilities of the Wimmera should irrigation come about. Mr. and Mrs. Roediger deserve the highest praise for what they have done, and when we have more homes of this kind, young men and women will be less likely to leave them and make for the cities. Messrs. Sanders and Dufty and Sons had very fine orchards well kept with a variety of fruits.

(J) THE BEST PROVISION FOR WATER SUPPLY.

This in a dry climate is a very important factor on a farm, and considerable expense has been entailed in providing sufficient water, and having it convenient for stock at all times. I was struck with the fine arrangements made for water supply on some of the farms. Large dams and wells have been sunk, windmills and tanks erected to convey the water to the farm yard, house, and garden, and everything done to lessen the

inconvenience of a country with a light rainfall. Messrs. Roediger and Sanders have gained highest points in water supply. The former by sinking a well has obtained, I might say, an unlimited supply of water, which is raised by a windmill, and run into a series of large troughs, each containing 600 gallons. These troughs admit stock from each side, or rather from two different paddocks, Another windmill raises the water from a large dam for house and garden purposes. This grand supply of water with conveniences right at the homestead, which is situated in a fairly central position of the farm, gained points in Mr. Roediger's favour. The water supply of the back paddocks is from another well and a large dam. The drinking and house water is conserved from the roof into tanks with a catchment capacity of about 6,000 gallons. Mr. Sanders has a very extensive and a naturally good supply of water in the shape of large dams, studded here and there right throughout his whole estate, which materially assists in the subdivision of stock into small lots when they do better. Mr. Sanders informed me the number of dams on his place is 22. The farm yard and garden are plentifully supplied by a windmill, and the house from a cement underground tank.

So that one dam may serve either of four paddocks, Messrs. Dufty and Sons have adopted the following plan:—



A handy yard is provided, fencing saved, and an outlet to water where required. Should either 1, 2, or 3 paddocks be under crop there is still an outlet to the other three paddocks.

(K) BEST ARRANGEMENT AND SYSTEM OF DWELLING HOUSE.

In this Mr. Roediger stands out with full points. His magnificent house with an avenue of trees leading up to it, and a break-wind of sugar gums, planted four deep on the west side, together with a beautiful flower garden, with here and there an orange and lemon tree, imbues a person on entering with the idea that here at least is a home where taste and neatness are practised. The house itself is well laid out, roomy where required, with a large kitchen and handy appliances. The outer buildings comprise a good cellar, store-room, wash-house, &c. In the farm yard are a good 17-stall stable and loose-box with handy feeding arrangements along the front of the stalls. The whole stable and chaff-house is enclosed with a fowl-proof fence. Wool sheds, machine sheds, granary,

piggery, fowl-house, and men's accommodation comprised the farm yard. The whole plan of the homestead is compact, and yet roomy enough to allow work being carried out expeditiously. Messrs. Dufty and Sons, who came second in number of points, have also a very fine homestead,

MR. O. H. ROEDIGER'S HOME AND GARDEN.

well laid out for convenience. Open large sheds, stables, and loose-boxes are scattered round an open yard, and strong railed fences indicate that horses are bred and yarded up in large numbers. Tree planting as a break-wind is a feature of Mr. Dufty's farm.

BEST FARM UNDER 640 ACRES AND OVER 100 ACRES.

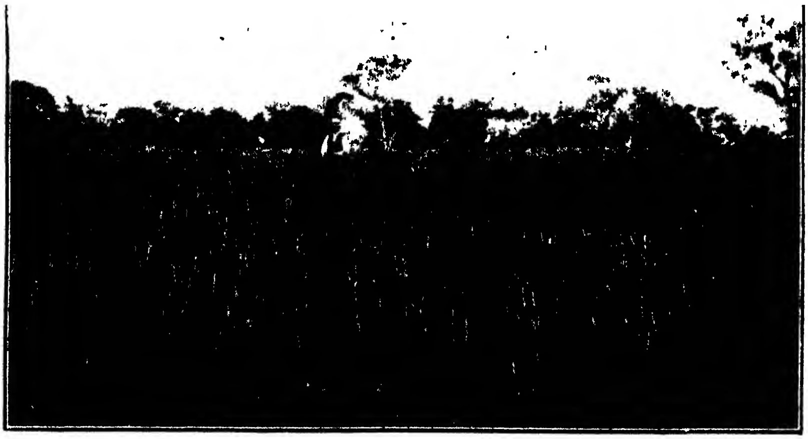
In this section there were only three competitors, and the points allotted to each are as follow ;--

Maximum points ...	15	10	5	10	15	15	20	10	10	30	20	160
Name	A	B	C	D	E	F	G	H	I	J	K	Total.
E. Hoffmann ...	14	6	2	9	15	12	16	9	8	26	18	135
W. T. Symes ...	14	7	2	9	13	12	16	6	7	28	12	126
C. Hensleit ...	14	8	3	8	14	10	12	9	7	20	10	115

It will be seen by the points that Mr. Hoffmann gains first prize; Mr. Symes, second; and Mr. Hensleit, third.

Mr. Hoffmann shows a splendid example of hard work combined with neatness—"a place for everything and everything in its place." It rather surprised me to find that a young man, single-handed practically, fallowed 200 acres of land and harrowed it twice, at the same time keeping the various other branches of the farm going. Any one visiting this farm would do well to note the condition of everything about the place. It speaks volumes for the enterprise and work performed by this gentleman. Mr. Hoffmann has a nice plantation of trees as a break-wind—the hedge at the foot of the garden neatly trimmed and in keeping with the surroundings. The house and farm buildings were all in good order and laid out

to advantage. The horses were useful kinds for farm work, with a couple of brood mares. The cows were ordinary, and were being crossed on to an Ayrshire bull. Sheep, good crossbreds. Lambs sold as freezers. The poultry have received some attention, and I have no doubt gave good returns. I noticed proper accommodation was made for them, instead of allowing them to roost here, there, and everywhere. The crops showed the effects of good cultivation and rotation. One piece of new land was unmanured, the balance manured with about 56 lbs. super., and a very fair crop of wheat is the result. Fences were good, with a number of new cyclone gates well hung. These give the fencing a good appearance and enhance the value of the farm. Water conservation had not been overlooked, two large dams and a windmill supply the farm yard and garden—underground tank for house supply. The kitchen garden was well stocked with vegetables. There were also a few experimental plots of linseed, wheat, &c. Altogether it is a good farm.



MR. E. HOFFMAN'S 120-ACRE PADDOCK OF WHEAT.

The other two competitors have excellent farms, and deserve credit for their work. Mr. Symes, I understand, has sold his place, and is leaving after harvest. This accounts for the want of a good stack of hay, straw, &c., that forms such an important part as a stand-by against years of drought. Every farm should have its stack of hay, straw, and ensilage. Dry seasons have occurred in the past, and as surely will come again. I cannot close this report without saying a word in commendation of Mr. Hensleit's farm, which in a few years time will be amongst the leading places. His homestead on rising ground in a central position of the farm lends itself to becoming one of the best laid out farms visited by me, and when the new house, with its orchard and improved water supply is accomplished, this farm will stand out as being unique in its neatness. I wish Mr. Hensleit and his family every success.

Wheat Crop Competition, 1905.

In this section fourteen competitors entered the field, one farmer, however, withdrew his crop on account of it bcoming tipped with the hot winds.

After due consideration in the various points, I have placed them as follows:—No 1 being first prize, No. 2, second, and No. 3, third, and so on in rotation.

Name of Competitor.		Cleanliness of Crop	Trueness to Type and Character	Evenness of Crop	Freedom from defects, Smut, Rust, Bunt, Whiteheads	Apparent Yield	Totals.
Maximum points	...	20	20	15	15	30	100
Geo. Crouch	...	17	15	14	12	28	86
H. A. Dahlenburg	...	18	15	12	12	27	84
G. Landers	...	16	12	14	13	26	81
A. Schultz	...	12	12	14	12	25	75
Henry Scroop	...	14	12	13	12	24	75
W. Sanders	...	14	12	12	13	22	73
R. Ervin	...	15	12	10	10	25	72
John Bond	...	12	11	13	12	23	71
P. C. Chiappini	...	16	11	10	12	22	71
W. Pohlner	...	12	11	10	10	26	69
J. C. Macdonald	...	12	12	10	12	23	69
J. W. Oldfield	...	15	9	8	10	22	64
D. Duthie	...	10	9	11	12	20	62

You will notice that in the scale of points adopted by me there are three important factors, viz.: (1) "cleanliness of crop"; (2) "trueness to type and character"; and (3) "apparent yield." In judging, I have paid particular attention to the second, "trueness to type and character." I take it that the aim of the Society in these competitions is education and improvement in the methods of wheat growing, and as the standard of cultivation has arisen considerably within the last few years, the next great requirement is to raise pure seed. Then, again, a farmer winning the prize in such an important competition thereby has his wheat advertised very widely, and being situated in the Wimmera, one of the best wheat-producing districts in Australia, it follows naturally that farmers from other parts will inquire for seed from a first prize wheat crop, and to provide seed with any degree of success it must be pure in every respect. I think the Society would do well to bear this in view and formulate a scale of points for judging wheat crops, and each succeeding year raise the number of points in this particular item, or in any other way offer inducements to competitors to raise the standard of quality and purity in any varieties grown by them. It is reasonable to admit that the farmer who can produce the largest quantity receives the highest returns, but unless that same farmer pays attention to his seed so surely will his yield gradually decrease and the quality of the grain deteriorate, or run out. So that if the Society will make for its aim, the combination of raising pure and typical varieties with the maximum of production, it will benefit not only the local district, but the whole farming community.

In judging the wheat crops, I was placed at rather a disadvantage, the season being exceptionally late. It follows the crops are backward and altogether too green to make comparisons as to how the grain was filling, and in estimating the apparent yield. However, all the crops examined were much alike in this respect, so that each competitor is placed on a fairly equal footing. The crops right through are good; in fact, much better than anticipated by me. There is not the least doubt that the Nhill and surrounding district is admirably adapted to wheat growing, combined with sheep raising. The high standard to which wheat growing has been brought is due, no doubt, to artificial manuring and the drill, together with a good system of fallowing; then later sheep were used for feeding off, at the same time supplying the want of a certain amount of nitrogenous manure. To-day the trade in freezers has made sheep a very substantial adjunct in the returns of the farm. This system might be called the bare-fallow sheep system of farming. When we have advanced still a step further and can grow a green covering on the fallow and stubble land to provide a bite for the sheep, and at the same time add the want of humus so necessary in conserving the moisture during the hot summer months, even better results will be achieved. This system of rotation will also supply the necessary proportion of nitrogen required to stimulate plant growth. It is well understood by all up-to-date farmers, that a variation in supplying the plant food must be adopted in the near future to keep the land in that state of freshness in which we found it when selecting 30 years ago.

For the benefit of those interested, I will make a few comparisons to show how points were obtained in several of the leading crops. No. 1, Mr. Crouch. This is a very fine crop, its chief characteristic being "fairly pure," "even," "well headed," and "clean," the apparent yield being estimated at fully six bags per acre. When it is considered that there were over 300 acres of fallow under wheat it shows that Mr. Crouch adopts some good principles in working his land and crop rotation. Mr. Crouch's fallow land is ploughed 5 inches deep, and is cultivated repeatedly to a depth of 3 inches with the harrow scarifier-tyne implement. This is done during the spring and early summer; the paddock is then left to sheep to do the rest throughout the summer. Fifty lbs. of seed per acre were used for sowing, and 40 to 45 lbs. manure (superphosphate). The whole of the crop was eaten off by sheep in the early winter. Varieties grown, Purple Straw and Dart's Imperial. No. 2, Mr. H. A. Dahlenburg, also has a good crop, and the undulating nature of the country gave a very pleasant view of a wheat field. This crop was beautifully clean and gained a point in this over No. 1, but lost two points in evenness, as it did not have that fine table-top appearance as in No. 1. No. 2 crop was fairly pure to type and character of the variety sown, but not what I would like to see in a crop securing a prize in this competition. The estimated yield was slightly under six bags average per acre, but weather conditions may alter this considerably. Mr. Dahlenburg sowed 50 lbs. seed per acre, with about 50 lbs. superphosphate. This crop was also eaten off bare with sheep in the winter. Varieties grown, Marshall's No. 3 and Dart's Imperial. No. 3, G. Landers, Salisbury. This is a very neat little lot of 120 acres. Points were lost in the cleanliness, as a few wild oats showed up here and there. The impurity of seed was more noticeable than in No. 2, but in evenness it pulled up considerably, also gained a point in freedom from defect, there being but very few white-heads

showing. This crop was sown thicker than any visited by me. In estimating the yield I was of the opinion that it would not fill so well on account of the heavy seeding. 60 lbs. seed sown per acre, with 50 lbs. manure (superphosphate). Crop not eaten off. Varieties, Australian Talavera and Purple Straw. No. 4, Mr. A. Schultz. It was a pity that such a fine crop was marred by weeds. Barley grass, poppy, and iron weed showed throughout this paddock to its detriment, and the purity was not quite so good as in the three former. I considered the yield would be pulled down from the effects of weeds. Mr. Schultz is a good farmer, and I would have liked to have seen him higher up in the list. Messrs. Sanders, Ervin, and Chiappini deserve credit for their crops, each one showing some good points. I may state that in all the crops there were signs of "Take all" showing in patches. Smut I saw in only one case, but it was rather early to detect fungus diseases, such as smut and bunt.

WEEDS THROUGHOUT THE CROPS GENERALLY.

Wild Poppy (*Papaver rhœas*). In passing through the crops I could not help noticing the rapidity with which the wild poppy has spread over the country. It is said to have first appeared after the heavy wind storms in 1902—the drought year. Unless some means of coping with it are taken it will mean a serious reduction in the average yield, as a plant with a fine penetrating tap root and heavy foliage must absorb a fair amount of nourishment and moisture to sustain itself, and this means robbery to the wheat plant. Smothering by growing oats may kill it. Harrowing or working the land lightly after the crop is well established should kill the young poppy plant by uprooting and burying under the loose earth. There is always the chance that it may propagate so rapidly as to kill itself by overcrowding and smothering. The seed is very minute and is easily carried by wind from one paddock to another, so that it is useless for one farmer to eradicate it, and his neighbour allow it to grow and ripen. Every one must do his share in this direction.

Iron Weed or Sheep Weed (*Lithospermum arvénse*).—This weed has been known for some considerable time, and makes its appearance at various periods in cultivation paddocks when conditions are conducive to its growth. Sheep keep it down in its early stages of growth, but later the stems dry, and it appears almost like a piece of wire, interfering considerably with harvesting machinery.

White Everlasting (*Helipterum corymbiflorum*).—This small daisy-like flower is a fierce feeder on the soil, and when once established subdues the wheat crop considerably. It grows generally on the poor hard patches where crop is thin. Fallowing and cultivating well to prevent seeding, or keeping the land in good heart, seems to overcome this weed to a great extent.

Pimpernel (*Anagallis arvénsis*).—This small weed is spreading on cultivation land in the Winiam district. It has proved a great pest in the more humid districts of Victoria, but I do not think it will make much headway in the Wimmera.

Wild Oats (*Avena fatua*).—This is an old friend, and was fairly prevalent on some of the farms, but as it provides a certain amount of good feed some of its bad qualities are overlooked. In fact, I may be wrong in classing this amongst the weeds, and will merely say "a plant out of place" when in a wheat crop.

In concluding my remarks concerning weeds, I would just draw attention to the fact of a very pernicious weed growing on the railway line at Nhill, and would advise that steps be taken to have it rooted out before flowering each year as it appears. It is known as Hoary Cress (*Lepidium draba*).

In conclusion, I would like to say that the Nhill Agricultural and Pastoral Society is working on the right lines for the advancement of agriculture, and trust it will get every assistance both from kindred associations and from the Government, through the Agricultural Department, not only in these farm competitions but in furthering experimental work. It is understood that a very large proportion of experimental research is carried on by scientists, working with costly apparatus and a carefully planned method which extends over a series of years. But of what use is all this work unless applied practically to the farm. And it is here that agricultural societies could be of advantage in bringing the scientist and his work within reach of the farmer. One of the greatest discouragements a farmer has to contend against is that scientists generally speak and write in a language almost unknown to him, and to overcome this difficulty there is but one way, and that is for the farmer and scientist to meet half-way and exchange ideas. In travelling through the different districts I noticed there was a general eagerness for information on improved methods of agriculture, showing that the farmers were fully awake to the fact that to keep pace and compete with other countries we must apply the latest improved ideas in our methods of agriculture.

Before concluding my work, I wish to thank all those whom I visited, and those with whom I was brought into contact, for their kindness and hospitality. I found in all instances that I derived beneficial information in conversing with the various farmers on agricultural topics, and trust that opportunities may arise in the course of time when acquaintances will be renewed. To Mr. Towns, your energetic secretary, I owe many thanks for the expeditious manner in which he carried out the various undertakings. The whole seven days' work was done without a hitch and was always arranged so that sufficient time was given to thoroughly investigate each and every lot competing. Owing to the tact shown by Mr. Towns in getting to work without loss of time on arrival at the different places, the task of judging was considerably lightened.

MR. H. A. DAHLENBERG'S DRAUGHT STOCK.

SURVEYING ON THE FARM.

A. S. Kenyon, C.E.

Levelling.

The Miner's Triangle.

So far attention has been confined to horizontal measurements. The earth's surface, however, is not very smooth, and vertical measurements, especially with regard to irrigation and water supply, roads, and drains are essential. The ascertaining of slopes and the relative levels of points, is called levelling. Here instruments are essential. A primitive, yet handy, contrivance is known as the "miner's triangle." It is formed of battens about 3 inches by 1, made in the form of the letter A. (See Fig. 17.) The slant pieces are made exactly equal in length, and the cross-piece is fixed to the slant arms at equal distances. A plumb-bob is suspended from the point, and hangs a little lower than the horizontal piece.

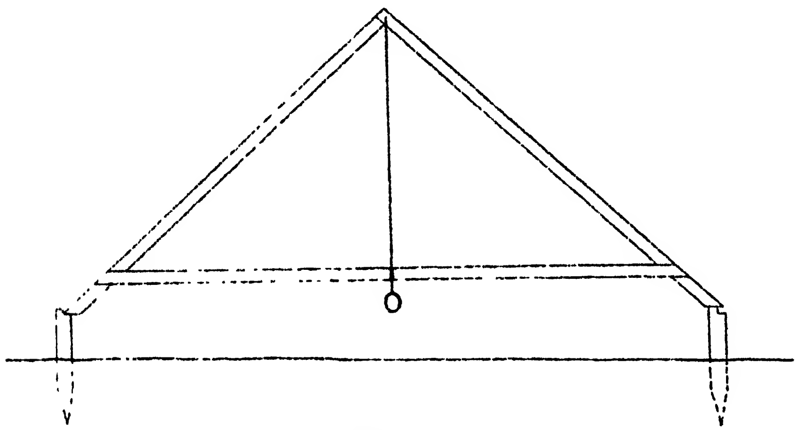


FIG. 17.

The ends of the slant pieces are exactly level when the plumb-bob string is truly in the middle of the cross-piece, where a mark has been carefully made. The opening between the ends is generally 11 feet, or one-sixth of a chain. At times it is as much as 16 feet 6 inches, one pole, or a quarter of a chain. Sometimes a spirit level is used on the horizontal piece in place of a plumb-bob. Before using it should be tested by driving two pegs, the proper distance apart, on the edge of water, making the tops of the pegs the same height above the water. These pegs are exactly level, and when the instrument is placed on them, the plumb-bob string should be exactly on the mark, or, if a spirit level be employed, the bubble should be dead centre. If not, the necessary corrections should be made. To set out a drain or grade line of any kind, adopt a particular fall, say, ½-inch per chain. Then, if the opening of the triangle be one-fourth of a chain, cut a step in the pegs of one-eighth of an inch in height, as shown in the figure. One leg of the triangle is placed on the starting peg, and another peg driven in under the other leg until the string or the bubble shows that it is level. On the next setting-up, the back leg is placed on the

cut step, and so on, so that the step in each peg is $\frac{1}{8}$-inch lower than that in the peg immediately behind it. The triangle is rather slow in use, and is only of service for levels along one line. Contouring of catchment areas or of irrigation paddocks requires a lighter and more generally useful instrument.

THE WATER LEVEL.

The water level is free from the faults mentioned, and may be easily made. About the best form is that shown in Fig. 18. It consists of a piece of water-pipe $\frac{1}{2}$-inch or thereabouts in diameter, with elbows screwed on each end. In the elbows are inserted medicine bottles with the bottoms cut off, and fixed in with plaster of paris or shellac. Short pieces of glass tube, such as steam-gauge glass, will answer the purpose as well. Corks for the bottles or tubes are required. At the middle of the tube, a nut or

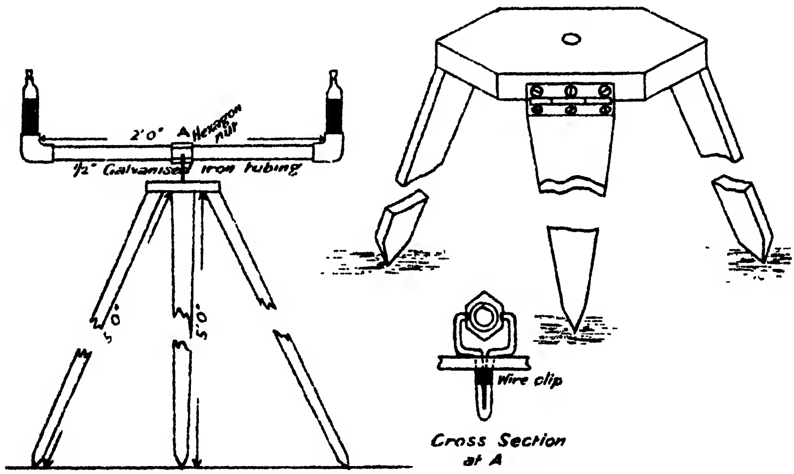


FIG 18.

ring is soldered on, and a swinging joint made, as shown in the drawing. The support should be capable of turning in the head of the tripod, which may be readily contrived with four pieces of wood and three hinges. Horizontal rotating and vertical dipping motions are required. Many other ways of constructing this instrument will readily occur. All that is required are two glass tubes connected by some sort of water-tight tube, some few feet apart, and capable of being turned in any direction. The level is given by pouring water, preferably coloured black with a little ink, into one end until it fills the connecting tube, and shows in the glass at the other end. A line sighted along the tops of the water in the glasses will be truly level. To shift the instrument, the corks are put in the glass ends, and the whole thing may be carried without risk of spilling. When setting up again, the instrument is set as nearly level by eye as possible, and one cork taken out. The water will not, however, move until the second cork is extracted, which is done very carefully. Sighting may then again be done. Before rotating the instrument, it is well to put

in one cork. An extra supply of coloured water should be carried in case of an accident. There is also required a staff 10 feet long, or more if practicable, marked off in feet and inches, made from a 3-inch by 1-inch batten. (See Fig. 19.) A cross-bar, blackened, with a box guide, formed

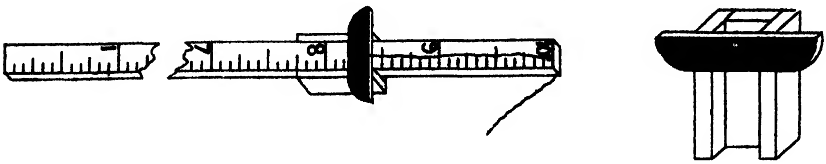


FIG. 19.

as in the drawing, slides up and down the staff by means of a cord running through a hole near the top, and worked by the man holding the staff. Other instruments such as drainage levels, consisting of a spirit level on a tripod or telescopic levels, are better avoided, as they are liable to get out of adjustment, and, once out, are not easily readjusted by persons unskilled in their use.

Levelling Operations.

The measurements of the levels of the surface, as shown by the readings of the staff, are really measurements downward from the level line along the tops of the water in the glasses to the ground. (See Fig. 20.)

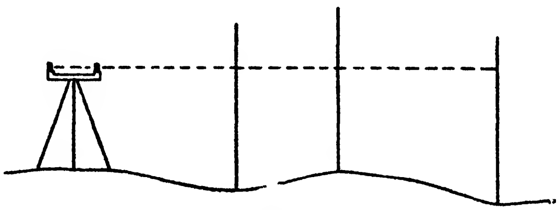


FIG. 20.

Consequently the lower the ground surface, the greater is the reading. An increase in the reading as the staff is shifted shows a fall, while a diminution shows a rise. In operation, set up the level where a clear view can be obtained of all the points required, or as many of them as possible; it need not be on the line or any place in particular. Direct the tube at the starting point. Remove the corks after having brought it nearly level, and sight the staff held by the assistant. He will move the cross-bar up or down, as indicated, until its top is in line with the water surfaces. He will then note the reading of the cross-bar, or call it out to the observer at the instrument, as arranged. The staff is then taken to the new position, and another reading obtained. This is repeated until the staff is getting too far away for accurate sighting. The staff-man should then select some good fixed point, such as a stump, stone, or even a piece of hard ground, and hold the staff on it; it need not be on the line, nor a point of which the level is required. When the observer has taken the reading, the staff-man does not move, but waits until the observer has shifted the instrument to a new position, and taken another reading of the staff at

the same point. The staff-man then proceeds to the next point, the level of which is desired. The notes of the work should be kept, as shown in the following example:—

Distance.	Reading.	Rise.	Fall.	Surface Level.	Bed level.	Cutting.	Notes.
0	5′ 6″	...	...	100′ 0″	98′ 0″	2′ 0″	Dam bank.
50 links	6′ 3″	...	0′ 9″	99′ 3″	...	1′ 3″	
100 "	4′ 2″	2′ 1″	...	101′ 4″	97′ 11″	3′ 5″	
150 "	4′ 0″	0′ 2″	..	101′ 6″	...	3′ [illegible]	
200 "	3′ 9″	0′ 3″	..	101′ 9″	97′ 10″	3 11″	
	2′ 9″	1′ 0″	...	102′ 9″	...	. .	On stump.
	3′ 2″	...	. .	...	...	...	
250 "	4′ 7″	...	1′ 5″	101′ 4″	.	3′ 6″	
300 "	4′ 9″	...	0′ 2″	101′ 2″	97′ 9″	3′ 5″	

In the first column is noted the distance along the line at which the reading is taken. In the second, the readings themselves are put down. When a change is made a horizontal line is drawn under the last reading noted, before moving the instrument, that is, the reading of the point at which the staff is to be read twice. The third and fourth columns are then filled in by subtracting a reading from the one next to it. When the second of two readings is the bigger, there has been a fall in the ground, as already explained, and *vice versâ* there is a rise when the first reading is the greater. In the case of the two readings separated by the horizontal line no subtraction is made, as these, being at the same point, and of course at the same level, cannot consequently show a rise or a fall. If the level of the surface at the starting point, 0 links, is not known, it is customary to commence the fifth column with 100 feet, that is to assume, for the purposes of comparison, that the surface level at 0 links is 100 feet. The surface levels at the other points are found by subtracting the falls and adding the rises, as shown in columns 3 and 4. Columns 6 and 7 have been added to show the application of the results thus obtained to a case of draining. In the sixth column, the bed levels of an assumed channel are set down, the channel having a depth of 2 feet at the start, and a fall of 1 inch per chain. The differences between these bed levels and the surface levels in column 5 give the depths of cutting required. In the last column any notes or remarks which may be required to make the figures clear and intelligible are put down. By running lines at right angles to a base line, the whole of a paddock, or any area, may be levelled, or, as this operation is termed "gridironed." Catch drains running on the contours, that is, the lines of equal level, check banks for irrigation, also preferably on contours, or drainage channels at right angles to the contours, may then be located and set out. Should a line require to be run with a tolerably uniform cutting with a known gradient or fall, the staff-man, after the first reading is taken, raises the cross-bar the required fall for one chain, say, ½-inch, and paces out a chain in the probable direction. If the reading is exactly on the cross-bar, the cutting at this point will be the same as at the starting point; if it be not upon it, the cutting will be more or less, and the observer must decide whether it will be worth while shifting the staff—and the line of channel—to save the extra amount of cutting or bank shown. The cross-bar is then raised another ½ inch,

giving again a fall, and another chain is set out. The observer must use his discretion as to the extent shortening the line will compensate for extra earth work.

Boning Rods.

Boning rods are often of use in grading a section of ground—such as the bed of a channel or surface of a road—between two points whose levels are given and which are not too far apart up to, say, 5 chains. A set of three is required, all equal in length and made T shaped, as shown in Fig. 21, and out of, say, 2-in. by 1-in. soft wood. The main points

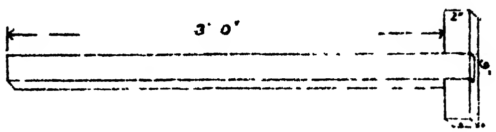


FIG. 21.

to be borne in mind when making the rods are—first, make all the rods the same length; second, get the cross-head truly square to the blade; third, make the top or sighting edge of the cross-head as straight and sharp as possible. The method of using the rods is shown in Fig. 22. ACDB is

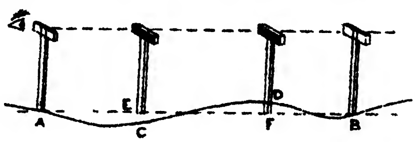


FIG. 22.

the section of a portion of a road bed it is desired to grade, A and B being points whose levels are known. It is desired to fill in or trim off the ground between A and B, so that the grade in the line joining them will be uniform. The operation proceeds as follows:—One assistant places his rod vertically at B, while the observer places his eye just behind the top edge of his rod held upright at A. A second assistant holds the third rod at the point C. He raises the rod until its top edge is in line with the sighting edges of the rods at A and B, as seen by the observer's eye. The rods all being of equal height, the bottom of the rod at C is therefore on the true grade line between A and B. A peg is driven in with its top flush with the bottom of the rod. Similarly the ground is dug away at, say, D, until the top of the rod held there is, as before, in line with the tops of those at A and B. A peg is also put in at this point. By these means, the grade line can be established at any number of points between A and B, as close as required. It is, of course, obvious that the rods must be held truly vertical to insure good results. For short sights no special trouble need be taken to prepare the sighting edges of the rods. For long ones, however, the best results are secured by whitening the cross-head of the far rod and holding it against a black background. If the cross-head of the intermediate rod be blackened, the two edges can be brought quite sharply into line with the sighting edge of the rod at the observer's end, and, on a clear day, sufficiently good work may be done up to distances of 8 to 10 chains.

A HINT FROM GIPPSLAND.

A. W. Curlewis, District Inspector of Stock.

The past year has proved beyond question that the matter of feeding should receive the earnest attention, in South Gippsland at least, of farmers who desire to make a permanent success of dairying. Through want of early autumn rains in many parts, there was very little growth of grass before winter set in. The latter part of the winter was unusually severe, and the spring unprecedently late, with periods of extremely cold, rough weather. These various causes have contributed to heavy losses of stock on the part of farmers who had no back country, and were not in a position to hand feed liberally. Probably the value of dairy cows which died through insufficiency of feed throughout Central and South Gippsland was from £50,000 to £60,000, and great numbers of those which survived and calved early, were not in condition to milk profitably. To a great extent this loss would have been avoided by hand-feeding properly, as was proved on those farms where it was practised, as shown by the few examples cited below.

Mr. B., of Poolman's Track, lost 22 cows out of 50; Mr. H., same locality, lost 10 cows out of 18; Mr. C., Allambee East, lost 16 cows out of 35, and Mr. D., Allambee East, lost 15 cows out of 40. These owners spent from £25 to £40 each in the purchase of chaff in an endeavour, when too late, to save their stock. Carriage on chaff was 2s. 6d. from railway station—10 to 14 miles distant. Others succeeded in saving their cows at an expenditure of from £40 to £100 on chaff taken delivery of at railway stations.

Of those who made provision for hand feeding, Mr. A., of West Alberton, cut 20 acres with maize. Fifteen acres of the same land were sown again with barley as the maize was cut. He also put in three acres with pumpkins for the pigs. On 315 acres of land, Mr. A. kept throughout the winter 125 cows, 20 young cattle, 16 horses, 80 pigs, and 100 ewes. The latter lambed in May, 100 per cent of lambs being marked. No stock were lost, and the cows milked through the winter were in splendid condition. Mr. A. assured me that the cost of cultivation, after the land was cleared, was practically *nil*. Mr. H., of Yarram, obtained equally successful results from hand-feeding. There are doubtless difficulties to contend with in clearing for the plough and cropping much land in the excessively steep and broken country of which a large portion of South Gippsland consists. On most farms, however, a few acres can be picked out here and there which could be ploughed with a strong team; two or more neighbours might combine forces for the purpose.

Another matter which has been neglected in South Gippsland is water conservation. Although the natural supply from streams and springs is generally plentiful and fairly permanent throughout the district, the necessity of making some provision to supplement this was proved last summer, when, owing to this neglect, a large area of good grass land was rendered comparatively useless. In many cases where the natural supply had not entirely failed, it was so scarce that it became foul and contaminated from the excreta of the cattle, and through being puddled up by them. If all land-owners whose properties are not watered by fairly large and permanent streams would have dams or tanks made, springs fenced in,

or wells sunk, and the water conveyed by suitable means into drinking troughs for their stock, they would reap great benefit in dry summers. They would be able to use all their country, and their stock would have a sufficiency of good wholesome water instead of being compelled to hang round muddy pools for hours at a time sucking up filthy moisture.

DISEASES OF FARM ANIMALS.

S. S. Cameron, M.R.C.V.S..

II.—GENERAL INDICATIONS OF DISEASE.

HISTORY.

The history of the case, by which is especially meant all ascertainable particulars as observed and detailed by those who have been associated with the animal from the onset of the complaint, is of the utmost importance in forming a diagnosis, if the information received is reliable. The tendency on the part of owners and attendants is to offer opinions on the cause and nature of the complaint, rather than to confine themselves to the relation of facts, which alone are of use to the practitioner. Exaggeration is also commonly indulged in, and it is unwise to place too much reliance on estimates by attendants relating to the breathing, quantities of urine and dejecta, or on matters in regard to which accurate judgment is required. Undue excitement, or a fancied importance on the part of the owner or attendant, generates a tendency to warp the judgment or over-state the facts. Leading questions should never be asked, except when it is desired to check volunteered statements, for oftentimes answers are given with the idea, unconsciously it may be, of anticipating the questioner's thoughts and reasoning, or of acquiescing in his supposed desire. Sometimes answers may be invented, and without the exercise of considerable perspicacity the practitioner may, for a time, be woefully misled. But, in regard to such matters as age of patient, duration of illness, character of food, nature of work, length of journey, exhibition of pain, and like matters of fact, there is little room for distortion, and the evidence can often be independently corroborated.

ATTITUDE AND APPEARANCES.

Observation of the attitude of a patient is always of material assistance in forming an opinion as to the nature of the disease; and, in some diseases, a keen observer may by this means complete the diagnosis without further examination. In pleurisy, for example, the turning out of the elbows and the fixing of the ribs, along with the distressed breathing, are characteristic and pathognomonic. The "stand" in laminitis (founder), with the body swung back, the feet thrown forward, and the weight resting as much as possible on the heels, to avoid pressure-pain at the front of the foot, can scarcely be mistaken, any more than can the "stilty" or "proppy" gait, and the protrusion of the haw of the eye when the head is elevated in developing lockjaw (tetanus). Nausea and dejection are eloquently indicated on the countenance of a sick animal. With a history of several deaths or current cases, a cow seen standing apart from the herd with back

arched, hollow flanks, slightly hurried breathing, and knuckling over on the hind fetlocks may be "specked" as suffering from pleuro-pneumonia.

Other examples of pathognomonic attitudinizing are:—The pressing or banging of the head against a wall in stomach staggers; the double flank heave in broken wind; the disinclination to lie down in acute lung affections; the languidly painful movement in colonitis; the "pointing" of the feet alternately in navicular disease; the S-shaped curve of the cow's neck when lying down in milk fever; the pawing and crouching and painful attitude in colic; the reckless tossing about and kicking the belly, and the anxious looking-round towards the flanks, in inflammation of the bowels (enteritis); the turning in a circle in "sturdy" in sheep; the straining after abortion; and the shivering of approaching fever.

COAT AND SKIN.

Closely associated with the attitude as an indicator of disease is the appearance of the coat. It may be dry, rough, and staring, or moist with sweat in the initial stages of febrile diseases. Profuse perspiration at any time is an indication of a want of balance in the circulation, and if not produced by some obvious cause, such as brisk exercise, it is significant of grave circulatory derangement. Cold sweats succeeding on grave symptoms during acute disease are often the precursors of approaching death.

In sub-acute and chronic derangement of the digestive tract, whether arising from improper food, intestinal worms, calculi, or other causes, the skin is dry, harsh, and scurfy, and the coat faded and sunburnt and devoid of gloss; and in some acute indigestions the presence of nettle-rash spots or "blebs" is the most prominent feature. The distension of the skin with gases in various blood poisonings (septicæmic deseases) is perhaps best exemplified in the inflated (emphysematous) condition of the limbs or quarters, which is a common feature of blackleg or symptomatic anthrax.

Itchiness of the skin, if not due to the presence of lice or other skin parasite, is usually an indication of some irritation of the stomach or bowels, and persistent rubbing of the tail against a wall or post is an almost unfailing sign of worms in the rectum or large bowel. A "hide-bound" condition of the skin suggests a non-thriving condition, and points to the necessity of supplementing the food with some oily or mucilaginous material, like linseed or boiled barley.

APPETITE.

In most diseases, but especially in those of the organs of digestion, the appetite is impaired. Often the first symptom observed at the onset of an illness is a diminished desire for food, or its refusal altogether at the regular time of feeding. Food may, however, be refused without there being any impairment of appetite, when pain is experienced during mastication or swallowing. This often occurs from irregularities, looseness or decay of the teeth, injuries to the tongue, soreness of the gums and lining membrane of the mouth from the irritation of "bearded" oats, for example, or from sore throat.

Mechanical impediment to swallowing by pressure on the gullet of a "strangles abcess," or by choking and inability to swallow through spasm of the muscles of the pharynx, as in lockjaw, or through paralysis, as occurs in acute cases of indigestion and "cripples" in cattle, may also account

for the disinclination to feed heartily. In all these cases, however, there will be evident eagerness for food, but inability to masticate or swallow it comfortably. In the last case there will be a dribbling of saliva from the mouth on to the ground or into the manger, and in cases of choking and lockjaw as much as upwards of half-a-dozen gallons may be so dribbled into the manger during the night. Inability to properly masticate is indicated by the animal "quidding" the food, that is, dropping it in bits from the mouth after it is only partially chewed. Sometimes animals will refuse food that is unpalatable either from mustiness, souring, decay, or other defect; but on the other hand it is surprising what inferior food-stuffs some animals, especially cattle, will consume when they are in health. It is by no means uncommon that disease is caused by owners unscrupulously taking advantage of this "omnivorous" propensity to (as they think) profitably use up inferior and rubbishy feed, the proper place for which is the manure heap.

In non-febrile complaints, the distaste for food is often due to the fact that the stomach or anterior intestines are already overloaded, and when this can be positively determined starvation for a time is wholesome and justifiable. In febrile diseases loss of appetite usually means loss of power to digest food, and this in turn results from the loss of secretive function by the numerous glands along the intestinal tract which normally elaborate the digestive juices; and, until there is a return to the normal activity of function on the part of these glands through the decline of the fever, it is as well to avoid forcing the appetite, and to withhold any but the most easily digested food, such as greenstuff, gruels, mashes, soups, and infusions. Even greenstuff is likely to do harm, except at the stage of commencing convalescence, on account of its liability to ferment if it remains long undigested, and, by the consequent formation of gases, to give rise to flatulence or hoven (tympanitis).

Depraved appetite is manifested, particularly by cattle, in sub-acute and chronic disorders of the stomach and bowels, and is indicated by a desire or craving to chew and swallow such miscellaneous articles as dead rabbits, old boots, slippers, hosing, bits of rope, rags, rusty tinware, hoop-iron, and other such rubbish. The chewing of bones or mortar or sea sand may be taken as indicating the absence of a sufficiency of calcareous and saline material in the soil and herbage; and the practice may be counteracted by allowing access to sterilized bonedust and rock salt.

In cattle, *cessation of rumination* or loss of the "cud," almost always accompanies loss of appetite, and with these animals it is the height of folly to give them any ordinary food until they regain the "cud," except, perhaps, a wisp of sweet hay, which may be given occasionally to act as a "starter" for rumination. The longer rumination is suspended, the more unsuitable for to be ruminated, by reason of souring and fermenting, does the food impacted in the paunch become. To continue feeding coarse food is only to increase the load to be carried, and the amount of unpalatable rumination to be got through afterwards, without any compensatory advantage in the way of nourishing the animal; for such food cannot be completely digested and assimilated until it has been re-masticated.

BREATHING.

The breathing is generally increased in frequency in all febrile and inflammatory diseases, but particularly in acute affections of the lungs. In active congestion of the lungs, the respirations may reach as high as

150 per minute. Apart from *frequency* and *infrequency*, which terms refer to the number of respirations in a given time, the breathing may be quick, as in the painful side "stitch" of pleurodynia, or *slow*, as in brain affections. These latter terms describe the length of time occupied by each respiratory act consisting of an inspiration and an expiration. The breathing may also be *deep* or *shallow*, *easy* or *laboured*, and *unequal* by variation of number of respirations per minute, or *irregular* by differences in time occupied for each single respiratory act.

The number of respirations per minute varies slightly with the kind of animal, and amongst domestic animals it is found that the smaller the animal the more frequent is the breathing. The following table gives the average rate per minute of the domestic animals when at rest in health :—

Horse ...	... 8 to 10	respirations per minute.
Cattle ...	... 12 to 15	,, ,,
Pig ...	... 12 to 20	,, ,,
Sheep ...	... 12 to 20	,, ,,
Dog ...	... 15 to 20	,, ,,

The frequency of respiration and pulse are in ratio of about 1 to 4½. An exception is seen in the cow when ruminating, during which process the pulse is usually increased to 70 or 80 beats per minute, while the respirations remain at or below normal. The ratio spoken of may be maintained during times of acceleration and decrease, even under conditions of disease, but most often it is then disturbed. In bronchitis, for example, the respirations may be as high as 60, 70, or even 80 per minute, while the pulse is only 60.

Abdominal breathing is a term used to indicate that the respiratory effort is assisted to a greater or lesser extent than usual by the action of the abdominal muscles. These muscles, by their contraction, compress the abdominal contents, forcing forward the diaphragm, and so assist in expiration. Abdominal breathing is associated with a distinct heaving of the flank, and is well seen in pleurisy, in which disease the movement of the ribs causes great pain; but this is avoided somewhat when the ribs are fixed and the abdominal muscles brought into play to assist in expelling the air content of the chest. In broken-winded horses, the most noticeable symptom is the double "heave" of the flank, caused by the extra effort of the abdominal muscles to expel the air from the distended air vesicles of the lungs. Conversely, when existing disease is accompanied by pain in the abdomen, as in peritonitis or flatulent colic, the respiratory effort is largely confined to the muscles of the chest (thorax), and the term *thoracic breathing* is used.

Stertorous breathing, or *snoring*, when occurring otherwise than during sleep, is usually associated with diseases affecting the brain. The muscles of the soft palate at the back of the mouth become paralyzed, and allow it to hang pendulous in front of the larynx, thereby impeding the expired air, which, by impinging on the hanging, flaccid mass, causes it to vibrate and emit a subdued rattling or snoring sound. Perhaps the most familiar example of stertorous breathing is met with in the unconscious (comatose) stage of milk fever in cows.

Fœtid breath.—The odour of the expired breath often betrays the use of certain medicinal agents of a volatile character. Over-doses of turpentine, for instance, or its mal-administration through the nostril, may be detected by smelling the breath. In severe cases of pneumonia the fœtidity or

foulness of the breath indicates an adverse change to gangrene or mortification of the lung substance, and consequently increased jeopardy of the patient. The breath is likewise foul in nasal gleet and other suppurative and purulent conditions of the respiratory mucous membranes and their discharges. It is of a particularly sickening character when ulceration of the bones of the nasal passage exists. *Sourness* of the breath is usually associated with stomach derangements, and is more often a result of eructations of sour gases from the stomach than of an exhalation from the lungs.

A *cough* is usually involuntary, and consists of a spasmodic closure of the larynx, necessitating a counter spasmodic and forceful action of the abdominal muscles during expiration, which causes sudden and forcible expulsion of a volume of air, accompanied by marked sound. There are many varieties of a cough, and these, by their character, afford some indication of the nature and location of the abnormality of which they are an evidence. The *dry cough* is met with in the early stages of bronchial affections, before the exudation of mucus has become profuse. When this occurs, the character of the cough changes to the *moist* variety. In pleurisy the cough is *dry*, *short*, and *painful*, and gives the impression of only a half-completed effort. Roaring is characterized by the *hollow* "graveyard" cough. The cough of asthma, or "broken wind," is dry, short, and feeble, and is sometimes described as a *suppressed* cough. A cough is sometimes present in diseases of the bowels, liver, and stomach— the so-called *stomach cough*; also during the irritative stages of dentition, when the cough is loud and paroxysmal. These "sympathetic" coughs are produced as a result of reflex irritation from the diseased part, and it is well to always remember that a cough does not necessarily mean derangement or disease of the respiratory organs only.

A *grunt* is caused by a narrowing of the larynx, with a continuous forced passage of air through the constructed opening.

Visible Mucous Membranes.

These comprise the mucous membrane lining the nostrils, mouth and lips, the conjunctiva of the eye, and, in the female, the inner lips of the vulva. While in health they are usually of a pale-red or carnation colour, due to the normal condition of blood supply, in disease they show distinct changes, which are of great importance, as being always available links in the chain of evidence establishing a diagnosis.

In conditions of debility, anæmia, and wasting disease, the visible mucous membranes are *pale* and *bloodless*, while in febrile and inflammatory affections the natural red colour is deepened to a florid red or deep purple. The term "injection of the visible mucous membranes" is applied to this condition because it depends on the engorging of the small blood vessels with an excess of blood, and it is therefore indicative of a deranged circulation. Sudden *pallidity* of the membranes accompanied by decline of local temperature is indicative of internal hœmorrhage, such as occurs in rupture of the liver. A *rusty red* colour is frequently associated with pneumonia, and a *rusty yellow* colour with diabetes. A *blue* coloration in newly-born animals is a diagnostic sign of the always fatal condition known as "cyanosis." Another common alteration of the membranes is met with in diseases of the liver and kidneys, when they show a varying degree of *yellow* coloration, from the washed-out yellow seen in sheep affected with "fluke" to the deep greenish yellow of jaundice. A *slatey* coloration and sliminess occur in certain febrile diseases of a

slow typhoidal character; and in some transmissible diseases a distinctive change is observed. For example, the salmon tint of the mucous membrane of the genitals of cows in rinderpest is said to be fairly characteristic. Again, a *coppery tinge* (the "copper nose" of the London night cab horse) is a fairly significant indication of latent glanders and farcy; and the pink coloration of the eyeball in one form of influenza is so constant as to have given rise to the distinguishing name "pink eye."

In septicæmic diseases, the hæmolytic or blood decomposition changes occurring in the blood are evidenced by the formation of small circumscribed patches of congestion or apoplexy (rupture of small blood vessels) throughout the body, but especially on all serous and mucous membranes, and these are plainly observable in the living animal on the mucous membranes of the eye and nostril. They are called petechial spots, or "petechiæ," on account of their resemblance to a flea-bite, and are particularly noticeable in pupura and petechial fever in horses, malignant catarrh in cattle and sheep, and swine fever in pigs. "Ecchymosis" is a term implying a similar condition of punctate hœmorrhage in solid organs, and is found in the same diseases. A common term for this condition is "shotted," the organ presenting the appearance of having been peppered with pellets of small shot.

Besides alteration of colour, the visible mucous membranes may show other conditions which are signs of disease. A *desquamation*, or "peeling off" of the epithelial covering of the tongue or lining of the mouth occurs in foot and mouth disease and in thrush. Dryness of the mouth, nostrils and eyes is often present in inflammatory diseases, and may be accompanied by a shrivelling of the tongue, as seen in milk fever and in inflammation of the bowels. An unduly moist condition of the mouth is symptomatic of disease of the teeth, oftentimes of choking and of the presence of a foreign body, such as a pin or thorn. A furred condition of the tongue is not of so much use in diagnosing disease of animals, but there is in some forms of dyspepsia a foul appearance of the mouth, accompanied by a sour smell—what is often termed "soapy mouth."

PULSE.

The rhythmic expansion and contraction or the oscillation of the walls of the arteries constitute the pulse beat. It may be felt by the finger in superficially placed arteries, or may be seen on exposure of an artery. It is caused by a wave of pressure (not a wave of blood) passing along the walls of the arteries as a result of the impulse given by the contraction of the heart. This pulse wave travels along the arteries at the rate of 30 feet per second, but the speed diminishes as the distance from the heart increases; so that, although the pulse beat corresponds to the heart beat, it is not felt at the same time, but a little later. Blood travels along the arteries at a much less speed—about 1 foot per second—so that the blood which is expelled from the heart by any given heart beat does not reach the spot where the pulse is being felt until considerably later than the pulse beat corresponding to such given heart beat has passed. It is essential that this should be plainly understood—that the pulse is not a wave of blood, but a wave of pressure, and that the character of the pulse does not depend, except slightly, on the quantity of blood in the arteries or on its rate of flow, but on the action of the heart and the condition of the walls of the arteries. According as the heart is strong, regular, weak, fluttering, intermittent, irritable or violent, the pulse indicates its condition.

The pulse may be felt at any place where an artery runs over a bone or hard tissue subjacent to the skin. The most convenient place in the horse is at the lower jaw, just where the facial artery winds round from underneath to the side of the jaw in front of the fleshy part constituting the cheek. The artery in this situation lies bare between the bone and the skin, and if the middle finger is pressed gently against it on the inner aspect of the bone, the pulse can be most distinctly felt. Other situations in which the pulse can be taken are:—At the subzygomatic artery as it lies bare against the bone at a spot about 4 inches below the ear, just in front of the posterior border of the lower jaw, and an inch or so below the joint; at the great metatarsal artery as it is exposed between the bone and the skin at the upper part of the hind cannon on the outside in a groove between the cannon bone and the outer splint bone; at the inner side of the fore-arm just below the elbow joint the posterior radial artery may be sufficiently fixed against the head of the arm bone (radius) to distinguish the pulse; on the under side of the tail, in the medium line towards the root, the pulse may be taken by pressing the middle coccygeal artery against the vertebrae of the tail.

In cattle the pulse is usually taken at the lower jaw, at the carotid artery in front of the shoulder, or at the underside of the tail. When the animal is lying down it may be best taken at the metacarpal artery, just below the knee on the inside, or immediately above and behind the fetlock. The pulse of the sheep and dog may be taken at the inside of the thigh, where the femoral artery passes over the inner surface of the thigh bone.

The rate of the pulse varies slightly with the age and breed or temperament of the animal. The younger and the more highly-bred and highly-strung the more frequent the pulse. During "season," pregnancy, and lactation in females, the pulse rate is also somewhat higher. The average rate of the horse's pulse is 40 beats per minute. In coarse-bred or old horses, it may range as low as 35, and in young stock, thoroughbreds, and ponies, as high as 45. In cattle, the pulse is extremely variable, and its frequency is not to be relied on as a guide in the diagnosis of disease. When the animal is completely quiescent, the pulse rate ranges about the same as the horse, but during rumination, or when excited from any cause, as by the approach of strangers or by strange surroundings, or on separation from its calf or other cattle, the cow's pulse may go as high as 80 per minute. The pulse rate in dogs is from 100 to 120 per minute. In sheep the rate varies greatly, according to age, the average being from 70 to 80 per minute, but in young lambs it may reach as high as 95, and in old sheep as low as 55.

Character of the pulse.—Increase of frequency of the pulse, when occurring as the result of disease, and not from excitation or the influence of stimulant medicines, is usually associated with disease of a febrile nature, and with such diseases as congestion of the lungs, or any disease in which there is interference with proper oxygenation of the blood; the heart in such cases having to make up for the deficiency by quickening the rate at which the blood is passed through the lungs. Decrease of frequency occurs in coma (unconsciousness) and other brain diseases, in which, on account of decreased nervous stimulus, the heart's action is lowered or inhibited. Medicines and poisons of a narcotic character also effect infrequency of the pulse.

The terms "frequent" and "infrequent," referring as they do to the number of beats in a given time, must not be confounded with the terms

"quick" and "slow," as applied to the pulse. A *quick* or "*short*" *pulse* is one in which the time occupied by the individual beat is lessened, and is indicative of irritability or jerky weakness of the heart. A *slow or "long" pulse* is one in which the beat is prolonged, and occurs in gross or flabby conditioned animals. So that, contradictory as it may seem, it is possible to have a pulse which is at once frequent and slow, or infrequent and quick, although the usual combination is frequent and quick, or infrequent and slow.

When a pulse beat is occasionally omitted, as occurs in structural disease of the heart, the pulse is said to be *intermittent*, and intermission may be *regular*, that is, the beat may be omitted always after a definite number of beats, or *irregular* when the interval occurs in no definite order. An irregular intermittent pulse is often met with in cases of chronic indigestion. The pulse is also differentiated according to the variation of its volume as felt under the pressure of the finger. It may be *large* and *full* to the touch when the heart is acting forcibly, or it may be *full* and *weak* as in the "oppressed" pulse of pneumonia. A *small weak pulse* indicates a weak contraction of the heart after debilitating disease or anæmia. A *hard pulse*, which is usually the kind experienced in pleurisy, peritonitis, and like inflammations of serous membranes, is one in which the artery resists compression by the finger, and it to the hardness is added smallness the term "wiry" or "thready" is applied. The pulse is frequently *wiry* in the early stages of inflammation when there is an increased determination of blood to the inflamed organ, and a consequent diminution of volume of blood in the superficial arteries. In founder of the feet (laminitis) the pulse is frequently in the condition described as *round*, full and hard. Other varieties of pulse are the *soft pulse*, the *double pulse*, the *venous pulse*, and the *running down pulse* of excessive hœmorrhage or approaching death, but perhaps already enough has been said to show that the characteristics of the pulse, under the influence of disease are many and varied, and require for their proper recognition, differentiation and interpretation great delicacy of touch, a large amount of patience and fine discrimination added to wide experience.

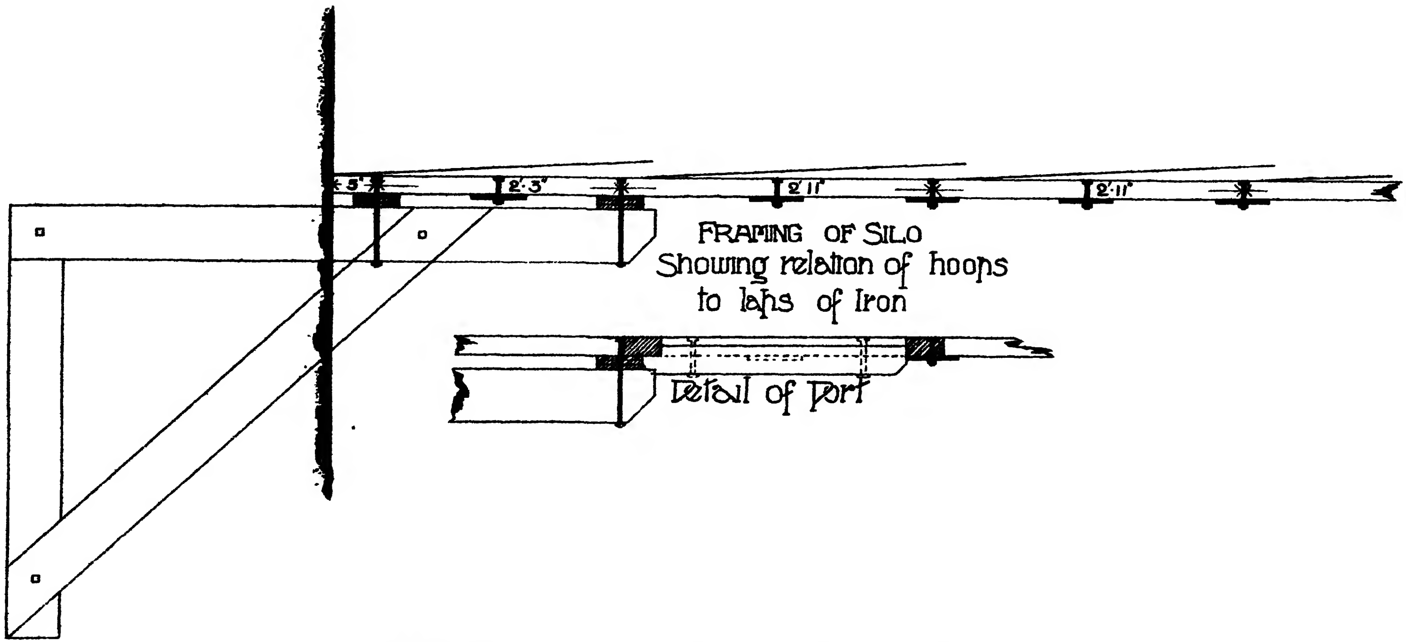
(*To be continued*).

BUILDING AN OVERGROUND SILO.

T. Cherry, M.D., M.S

The following considerations are to be borne in mind:—

1. The foundation must be firm enough to secure the silo when empty against the force of the wind.
2. The woodwork close to the ground must be protected against dry rot and white ants.
3. The material for the hoops requires to be straight grained, and free from knots and gum veins. A long lap is made at each splice, and bolts used so as to avoid splitting the timber.
4. The iron lining requires to have a lap of about 3 inches at the joints. If the clout nails are not more than 4 inches apart, the lining alone will be strong enough to take the pressure of the silage. The nails must be in the centre-line both of the lap and of the stud.



MATERIALS FOR SILO, 15 FEET DIAMETER, 21 FEET HIGH.

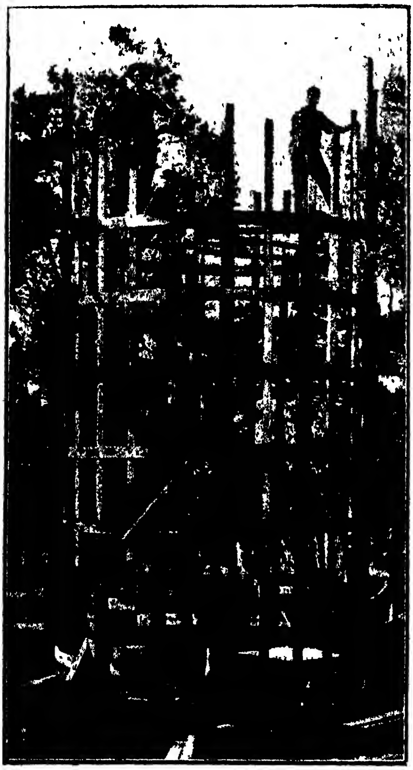
6 x 4 Redgum, 8/6, 8/5, 8/4.
4 x 2 Hardwood, 27/21, 6/24, 1/20, 6/16.
3 x 1 „ 2/12.
6 x 1 „ 4/11
6 x $\frac{1}{2}$ „ 60/18
8 6 x $\frac{1}{2}$ Bolts, Nuts, and Washers.

16 9 x $\frac{1}{2}$ Bolts, Nuts, and Washers.
16 8 x $\frac{3}{8}$ „ „ „
250 3 x $\frac{1}{4}$ „ „ „
100 4 x $\frac{3}{8}$ „ „ „
56 sheets 6 x 3 x 24 G. plain Galvanized iron.
16/8 sheets Corrugated Galvanized iron.

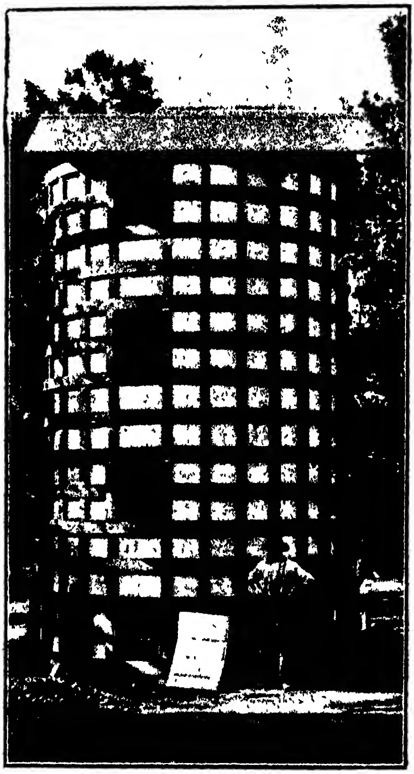
3 lengths 14" ridging.
2 lbs. springhead nails.
20 lbs. assorted wire nails, mostly 2".
20 lbs. 1" clouts.
2 lbs. Tinsmiths' rivets.
4 gallons tar or elastic carbon paint.

Specifications for Silo 14 feet 8 inches inside Diameter and 21 feet High.

All the materials used are to be of approved quality and the best of their kind. The timber to be specially free from knots and gum veins. The foundation posts, bottom hoops, and the bottom 3 feet of the studs to be tarred before fixing.



FRAME IN COURSE OF ERECTION.



SILO COMPLETE.

The Foundation.—Prepare eight foundation posts (6 x 4 redgum), as shown in sketch. Bolt the sole and post together edgeways, and halve the strut in both post and sole. Secure with ½ inch bolts. Fix a peg in centre of site, and with a trammel 7 feet 8 inches in length describe a circle. Dig for, and, when in position, fill in and well ram the posts 3 feet in the ground and 3 feet out of it, so that the inside face of each post is true to the end of the trammel. From the centre line of this face to the same line in the next post is 5 feet 10 inches, measured straight. Be careful to keep the inside face of each post exactly perpendicular. Make a composite curved plate by nailing three of the 6 x ½ boards to the inside of the posts, carefully springing the first of them to

the circle described by the trammel. Make butt joints, and let each successive hoop break joints. This hoop should be kept at least an inch from the ground. They require for the present only to be lightly nailed together, as they will be bolted to the posts in the way to be described below. A similar triple hoop is fixed, so that its upper edge is 35 inches from the ground. These two curved plates are used to fix studs in upright position safely.

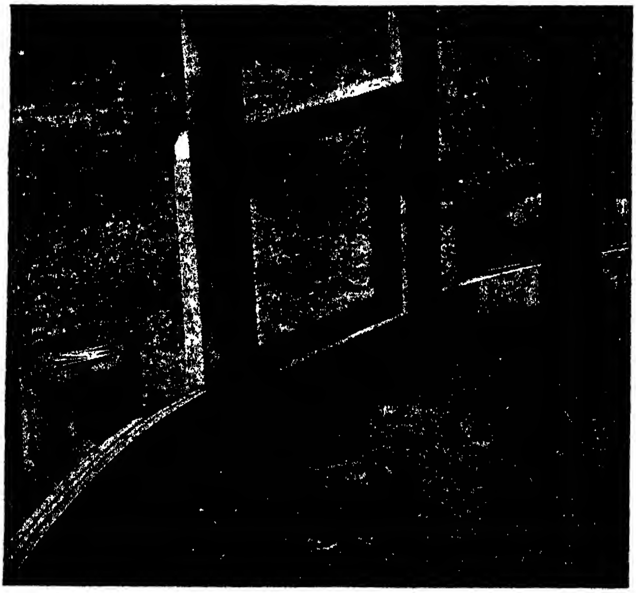
THE FRAMING.—The framing is made of 4 x 2 hardwood studs, placed sideways on the inside of the hoops. They are marked and bored for the ⅜ bolts before fixing. The ends are kept an inch off the ground. Every fourth stud comes opposite one of the posts, and these are bolted with 8 x ⅜ bolts passing right through the posts and studs. The intermediate ones are bolted with 4 x ⅜ bolts to the curved plates. In all cases, keep the nuts on the outside of the silo, so that they may be tightened as the hardwood shrinks. The spaces between the studs (except the pair which take the port-holes) are 13⅛ clear, measured on the inside edge of studs. A sheet of iron should be tried against every fourth stud, so as to see that the lap is correct. The hoops are 17½ inches apart, centre to centre. The upper hoops are marked as to the line at which they will cross each stud before they are fixed, so that the diameter of the silo remains the same all the way up. This is done by first bending them round the outside of the circle of studs at 3 feet from the ground, and marking the position of each stud on the hoop. (Of course the hoop must be fixed to the stud from which it was marked.) The lap of the two boards forming the hoops should be from 24 inches to 30 inches, according to the quality of the timber, so as to more than cross two adjacent studs. Bolts are passed through these studs and both hoops, as shown in Fig. 5; ⅜ bolts to be used to secure the hoops at every alternate stud. If the end of a hoop is cracked, bolt over the lap a fishing piece to cover three studs. The studs are kept plumb as the hoops are fixed. The first one to be erected should be one of the sides of the port holes.

THE LINING.—Twenty-four gauge galvanized iron is used. The lap is 3 inches on the studs, and one inch top and bottom. Press the sheets out to the line of the circle before nailing; 1 inch or 1¼ inch clout tacks are used, 3 inches apart along the lap, and 6 inches apart on the other studs. Three tinsmiths' rivets to be used between each stud to secure the horizontal lap. The edge of the lower sheet in each lap is *inside* the upper sheet, so as to exclude the weather.

THE ROOF.—Construct roof by bolting three 16 feet 4 x 2 purlins to the top of the studs of each half of the silo, allowing a pitch of about 3 feet to the ridge. Use 24 feet studs for the purpose of carrying the purlins, placing them in the circle where directed. Cover the roof with 8 feet corrugated iron 26 gauge, allowing one and a half corrugations lap, with spring-head nails at every third corrugation. Provide and fix three lengths of G.I. ridging 14 inch.

THE PORT HOLES.—The space between the last stud and the one first erected is made 22 inches clear. This makes the space between the last and the last but one less than 13 inches. A port is made in every second row of iron, the sill of the first one being 3 feet from the ground. The sill and lintel are made of 4 x 2, the top of the sill being flush with

the top of the hoop. The studs are backed up on their outer surface between the sill and lintel by pieces of 4 x 2, which are notched to cover the ends of the hoop corresponding to the middle of the port, and the whole secured with ⅜ bolts. The sill is nailed to the inside of the hoop so that it is flush with the studs on the inside. The stops are 3 x 1, set 1 inch back from the inside face. The rectangular piece cut from the corresponding sheet of iron is backed up with three or four pieces of 6 x 1, each 22 inches long, so that they fit close against the stops. The iron sheet then laps 1 inch or more all round the inside, and the pressure of the silage keeps the door against the stops. The doors are placed into position as the silo is filled, and they are knocked back into the silo as each becomes exposed, as the silage is emptied from the top. Short lengths of 4 x 2 studs may be placed between each lintel and the sill above, to support the iron lining.



PORT HOLE, FRAME SEEN FROM INSIDE OF SILO.

Roof.—The roof may be left until the silo has been filled, as the silage forms a good scaffold to work from. The easiest method is to thatch it with straw, a few light saplings being laid across on top of the uppermost hoop, the straw thrown on top of them, well topped at the centre, and secured by a few strands of fencing wire from side to side. Another method is to make a low-pitched roof, as in the specification. The gable takes the head of the elevator. This roof may be covered with iron, paling, or ruberoid. The circular conical roof looks best, and is easily made. A light frame is secured to the tops of every third stud, and the rafters carried up to a centre post. It may be covered with flat iron, ruberoid, or 12 x 1 boards which have been ripped diagonally, so that all the points may be turned to the centre post. The need for a roof is

much less in dry districts, and it will be found that the rain which drifts down the inside of the half-empty silo does most of the damage. Still, when the silo has been built full height, it is advisable to complete the roof.

The cost of these silos may be calculated from the subjoined table of materials. In addition, a 100-ton silo requires 20 lbs. clout nails and 56 lbs. bolts and nuts. The contract price for the whole of the materials for the silo (15 x 21), as per specification, including roof, was £20 16s. (December, 1905). This included redgum foundation posts bolted together and tarred; studs bored for hoops, and tarred for 3 feet up, and the battens for the three lowest hoops were also tarred; all materials loaded on truck at North Carlton railway station. A silo 30 feet in diameter and 30 feet high (no roof) was erected at Adelaide Vale for £70. Another at Serpentine, 22 feet in diameter and 35 feet high (no roof) for £52. When more than 18 feet in diameter, it is handy to have a line of ports on opposite sides.

Overground Silos.

DETAILS OF DIMENSIONS, CAPACITY, AND MATERIALS REQUIRED.

Length of Trammel.	Inside Diameter	Height	Capacity.	Studs.	Battens.	Iron.	Approx. Weight. 6 x 3 x 24g. Black.	Approx. Weight. 6 x 3 x 24g. Galvd.
	Ft. In.	Ft.	Tons.			Sheets	T. C. Lbs.	T. C. Qrs.
		21	45		60 17 ft. 6 x ½	49	0 7 0	0 8 3
6 9	12 10	24	56	29	66 ,, ,,	56	0 8 0	0 10 0
		30	80	.	78 ,, ,,	70	0 10 0	0 12 2
		21	60	...	60 18 ft. 6 x ½	56	0 8 0	0 10 0
7 8	14 8	24	73	33	66 ,, ,,	64	0 9 16	0 11 2
		30	100	...	78 ,, ,,	80	0 11 44	0 12 1
		21	76	...	80 17 ft. 6 x ½	63	0 9 0	0 11 1
8 7	16 6	24	94	37	88 ,, ,,	72	0 10 32	0 12 3
		30	130		104 ,, ,,	90	0 13 0	0 16 1
		21	95		80 18 ft. 6 x ¾	70	0 10 0	0 12 2
9 5½	18 3	24	118	41	88 ,, ,,	80	0 11 48	0 13 1
		30	160	...	104 ,, ,,	100	0 14 32	0 17 3
		21	135	..	100 18 ft. 6 x ¾	84	0 12 0	0 15 0
11 4	22 0	24	165	48	110 ,, ,,	96	0 13 64	0 16 3
		30	230	..	130 ,, ,,	120	0 17 16	1 1 1
		21	190	...	90 20 ft 6 x ⅞	98	0 14 0	0 17 2
13 2½	25 9	24	230	57	100 ,, ,,	112	0 16 0	1 0 0
		30	310	...	120 ,, ,,	140	1 0 0	1 5 0
		21	270	...	108 20 ft. 6 x 1	112	0 16 0	1 0 0
15 0	29 5	24	320	65	120 ,, ,,	128	0 18 32	1 2 3
		30	450	...	144 ,, ,,	160	1 3 0	1 8 3

NOTES ON BUILDING THE SILO.

The foregoing directions should be followed out to the letter, as every point has been emphasized by the experience obtained in erecting nearly a hundred silos of this type. The foundation posts may be made

long enough to stand more than 3 feet out of the ground with advantage if the silo is intended to be more than 25 feet high. Round or split timber will do for the posts, but if these are used it is necessary to adze the inside face exactly perpendicular, so that the triple hoops may be quite true. The upper edge of the third hoop from the ground must be exactly 2 feet 11 inches. This then allows an inch of the first row of sheet iron to show above this hoop, and thus riveting may be done with ease. The first port-hole may be made level with the lowest hoop if it is intended to excavate below the surface of the ground at any time, as shown in the accompanying illustration; but, if not it is handiest to make the first port 3 feet from the ground. The distance of 3 feet from one point to the next is not a disadvantage in practice, as when the silo is being emptied, as soon as the top of a port becomes visible, the silage is excavated from behind the door until it can be opened, and the silage then raked down the slope towards this port, instead of being worked quite level as is recommended for the next 3 feet. Should it be desired to fill the silo while it is being erected, there is no difficulty in doing so. The lining is commenced from the bottom, and kept two rows of sheets ahead of the filling. The sheets should be painted before they are nailed up, and whitewashed as soon as the riveting is complete. This extra treading on the silage is an advantage, and there is also no difficulty about the scaffolding. In the ordinary way, a couple of 9 x 1 planks are used as a scaffold, resting on the hoops in succession as the silo is built, and the iron is nailed on, beginning from the top. Remember that each row of iron loses 1 inch from the lap, so that the top edge for a 21 feet silo is 20 feet 6 inches from the ground. It makes a neat finish to the top if an extra 6 x ½ board is nailed on the *inside* of the studs, so as to project 4 inches above the edge of the iron. If thought advisable, the whole of the materials may be tarred or painted before erection, and the iron should always be treated in this way, at least on the inside, to protect it against any acids that may be formed. As an additional safeguard, two or three wire ropes (the same as those used for stays) may be placed round the studs, say, at 5 and 8 feet from the ground, and twitched up tight. This is advisable if the silo is 30 feet high, or in any height when the timber is not of first quality. In fixing the purlins for the roof, the edge of the studs hardly needs notching at all, the bolt being quite strong enough to hold them together. In very tall silos, where the foundation posts stand, say, 6 feet out of the ground, another triple hoop may be built as part of the foundation at this height, and in all cases when any of the lower hoops show weak parts (knots or gum veins), they should be strengthened by making them of a double thickness of 6 x ½ timber. The foundation hoops of silos above 25 feet diameter are made of two thicknesses of 6 x 1 instead of three of 6 x ½.

Staying the Frame.

A tall silo exposes considerable surface to the wind, and although the circular shape is the best to meet wind pressure, it is necessary to take precautions to keep it upright when empty. For this purpose stays are placed at regular intervals round the sides. Three of these are sufficient for a small silo, four for one 18 feet in diameter, and six for the larger sizes. They may be made of a good sapling, or built of 4 x 2,

as shown in the accompanying illustration; or, what is perhaps the best method, is to secure the frame by wire ropes (or six strands of fencing wire twisted together) to a good post twenty or thirty yards away. This allows the teams to draw in to the chaff-cutter without inconvenience.

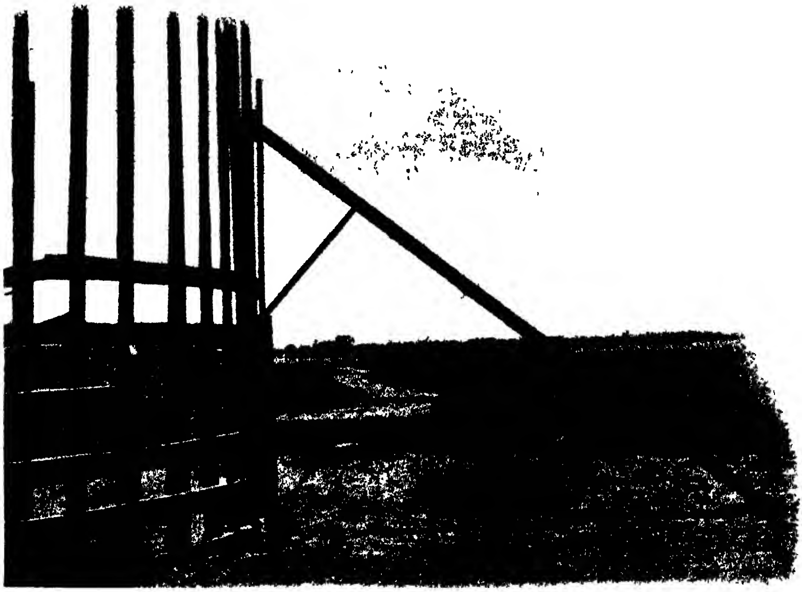


FIG 5.—DETAILS OF STAY. METHOD OF JOINTING HOOPS.

ENLARGING A SILO.

The silo built in this way is designed specially to allow of being increased in depth. The easiest way is to excavate the interior in a circle, as large as the inner face of the posts, to a depth of 6 or 10 feet or more. This gives 4½ clear all round, and allows of a brick lining. If the walls are good clay or slate reef, they may be made smooth enough without bricking, and in that case the diameter of the excavation is precisely the same as that of the finished silo, so that the inside face is perpendicular whatever the depth may be. Any irregularities may be plastered up with clay. If lined with brick, the inside should be finished smooth with a good coat of cement. When short lengths have to be used for the studs, these may be jointed in the following way:—The upper piece of 4 x 2 is halved for 9 inches, so that a 6 inch bolt is passed through the top of the lower 4 x 2, and then through the 2 x 2 tongue. In this way the upper studs are shifted sideways out of line with the bottom ones 2 inches; but the inside face is kept true. The long and short studs should be used alternately to break joints, and an extra hoop may be used to strengthen the silo in this part. As an instance of enlarging the silo, Messrs. McDougall Brothers, Minyip, built one 18 feet high last year, and now they have excavated it 10 feet below the surface,

and lengthened the studs by 7 feet, making the total depth 35 feet. In the rush of the first season's work, it is often impossible to build it more than 18 or 20 feet, but next year the depth should be increased to 30 or 40 feet. Remember, a narrow, deep silo is better than a broad, shallow one.

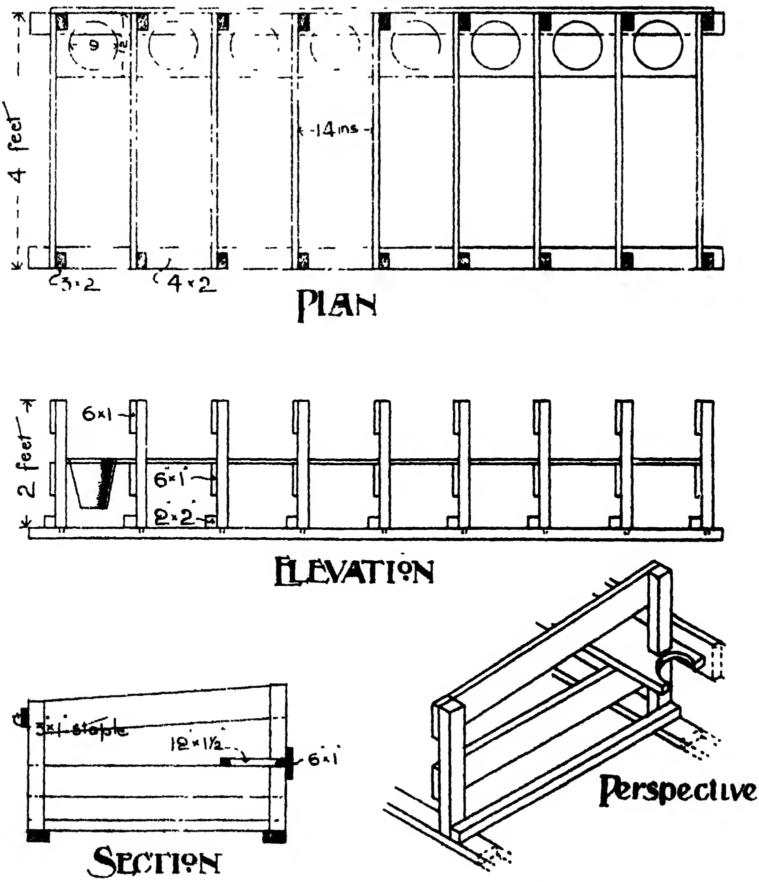
To Fill the Silo.

1. Before filling, whitewash the inside with a thick wash made of lime and skim milk. As this dries in a few minutes, it is sufficient to whitewash the iron each evening high enough to allow for next day's filling.
2. As the ports are placed in position, see that they fit closely all round. If necessary, use thin clay to lute the joint.
3. As the filling goes on, it is impossible to tramp it down too much, especially at the sides. Get the youngsters from the nearest school to spend a couple of hours in the silo each afternoon.
4. From 4 to 10 feet of filling a day is a satisfactory rate.
5. When full, wet the top layer of silage thoroughly. Then spread a layer of old cornsacks, and cover with at least 6 inches of sand or earth. This is specially required when the silage is made of one of the cereal crops, but is not so necessary if maize or amber is used, although even then it is an advantage. A cover made of bags sewn together, and tarred, will last several seasons.
6. The shorter the stuff is cut, the better—½ inch is better than 1 inch.
7. The elevator requires to be driven slowly for a chain-belt elevator, but quickly for a blower.
8. The ordinary chaffcutter, with horseworks, will fill a small silo, but an engine is better for the larger sizes.
9. Arrange the work of filling so that the sheaves are carted direct from the binder to the cutter.

CALF-FEEDING AT CALROSSIE.

R. T. Archer, Dairy Supervisor.

Mr. D. T. McKenzie is one of the most widely known and most enterprising of farmers in the State of Victoria, and whatever is undertaken at Calrossie is conducted on the best known lines. So it is with calf-feeding. About 100 calves were being reared there at the time of my last visit, and the system adopted might well be copied by any one rearing calves, for it is recognised that the improvement of the herd has to take place through the calves. The best bulls for the purpose are obtained which insures the progeny being superior to their predecessors.



The accompanying illustration represents a set of calf-feeding bails made so that they can be easily lifted about from place to place. It consists of eight bails 14 inches wide by 4 feet long, made of two sole plates of 4 in. x 2 in. hardwood, into which at the front and back of each bail are mortised uprights of 3 in. x 2 in. The partitions are made of 6 in. x 1 in. and the sole plates are joined by 2 in. x 2 in. A piece of

6 in. x 1 in. runs along the front of the bails about half-way up, as shown in front elevation. Right across the front of bails, as shown, a 12 in. x $1\frac{1}{2}$ in. hardwood plank runs, in which, in each bail, a round hole about 9 inches in diameter is cut. Into this a tin is placed, holding about $1\frac{1}{2}$ gallons of feed. At the back of each bail-post a staple is fixed so that a 3 in. x 1 in. or 2 in. x 1 in. batten can be slipped to bail the calves up, or a chain hooked across. Another similar set of bails for older calves is made 5 feet from front to back, being a foot longer. The feed is put into the tins and eight calves are bailed up, each calf then gets his own allowance, and the advantage of this system is very evident when it is seen that often some of the calves have their allowance consumed before others have well started, some being very slow drinkers, others quick. These are prevented from getting too much and thus causing stomach troubles. The others are assured their share, and so instead of being weaklings, develop into sturdy, healthy animals. The tins are thoroughly cleaned out every day, as are also the pens and calf-house, the floors of which are of brick and cement. These are scrubbed down every day, thereby keeping everything sweet and clean and sanitary.

The calves are fed on their own mother's milk or beestings for three days, and new milk for two weeks, half new and half skim milk for another week or so, when they are put entirely under separator milk, with which a substitute of some kind is mixed. Cod liver oil is used at present. This is mixed in the milk as it runs from the separator, and in this way has the effect of preventing the accumulation of froth on top. If the froth is fed to calves it is sure to create stomach trouble, and should always be removed prior to feeding. The vats and other utensils used are kept scrupulously clean, and the milk fed at a proper temperature, as nearly as possible 100 deg. Fahrenheit. The calves are supplied with lucerne hay in racks so that after being fed they can nibble at it. This is a great assistance in rearing calves. A little fine hay supplied in this way often prevents calves from sucking each other's navels.

THE ARTIFICIAL MANURES ACTS.

Unit Values for the Year 1906.

W. Percy Wilkinson, Government Analyst for Victoria, and Acting Chemist for Agriculture.

The Victorian Artificial Manures Acts are framed expressly to protect any farmer from being charged undue prices for artificial fertilizers, and to insure that vendors of fertilizers deliver their goods up to the composition and quality claimed by label and invoice.

The first of these objects is secured in a more or less arbitrary, but nevertheless in a practically useful manner by annually establishing and publishing unit values for the fertilizing elements of Nitrogen, Phosphorus, and Potassium, in the forms in which they are contained in artificial manures. This is done on the basis of chemical analyses and declared sale prices for the current year of all manures handled on a commercial scale in Victoria.

Analyses are carried out in the State Government Laboratory of samples of all manures not liable to vary in composition required by the

Manures Acts to be submitted for analysis, once each year or oftener, by manufacturers and importers. From these analyses the unit values are calculated, and are applicable to all sales of manures for a period of twelve months from the date of publication in the *Government Gazette.*

The unit values are, in other words, the average trade values of the three most essential elements of plant foods, namely, Nitrogen, Phosphorus, and Potassium, in the forms in which they are commercially available.

The approximate value per ton of any fertilizer sold in Victoria is obtained by multiplying the percentages stated of the fertilizing ingredients by the unit values fixed therefor in the list and adding the separate values together :—Examples : -

1. Sulphate of Ammonia. Invoice certificate. 20 per cent. Nitrogen.

Calculation : 20 x 14s. 4d. ...	=	£14	6	8
Calculated value per ton ..	=	14	6	8

2. Superphosphate. -

Invoice certificate, 21 per cent. Phosphoric Acid (Water Sol.).
,, ,, 2 per cent. Phosphoric Acid (Citrate Sol.).
,, ,, 1 per cent. Phosphoric Acid (Insoluble).

Calculation—

Phosphoric Acid (Water Soluble), 21 x 4s. 6d.	=	£4	14	6
Phosphoric Acid (Citric Soluble), 2 x 4s. ...	=	0	8	0
Phosphoric Acid (Insoluble), 1 x 1s. ...	=	0	1	0
Calculated value per ton ...	...	£5	3	6

A noteworthy feature of the unit values fixed for the year 1906 is the substantial reduction in the valuations for compounds of Phosphorus as compared with those of previous years :—

	1894.	1900.	1905.	1906.
	s. d.	s. d.	s. d.	s. d.
Phosphoric Acid (Water Soluble) ...	6 0	6 0	5 3	4 6
Phosphoric Acid (Citrate Soluble) ...	6 0	4 6	4 8	4 0

The decrease in the calculated value for an average superphosphate in 1900 as compared with that for the present year is striking.

The sample of superphosphate referred to in the above calculation would have been valued at £6 18s. in 1900, while its cost according to present market values is only £5 3s. 6d. This gratifying condition of the fertilizer market is to be attributed largely to the increasingly active competition in the rapidly expanding trade with artificial fertilizers. It is also in part due to improvements in the technique of handling and manufacture, and the increased facilities afforded to trade and manufactures by Australian Federation.

The protection of the pockets of purchasers of artificial fertilizers is an important aim of the Victorian Manures Acts. The laws render it illegal for any person to consign or sell in this State any parcel of manure exceeding 56 lbs. in weight, except under invoice certificate and attached printed labels. The invoice certificate and labels (tags) must convey definite information to enable the vendor to be identified, and the claimed value of the parcel of manure to be verified by chemical analysis. Thus the percentages of the commercially valuable constituents must be declared by

invoice and label. Any departure below certain limits from the declared percentages of plant fertilizing constituents and those found on analysis constitutes a breach of the law.

This system of compulsory declaration of percentages of fertilizing constituents in manures affords a considerable measure of protection to Victorian farmers. Every purchaser of manures possesses the right to send samples for analysis to an official analyst. By this provision of the Manures Acts any purchase of manure may be checked by the individual farmer with respect to the percentage values and quality claimed. An additional device for the protection of purchasers of manures is provided by the powers of inspection and analysis vested in the authorized officers of the Government Laboratory. The inspecting officers may enter any place where manures are stored, or in transit, and remove samples for analysis. The latest amendment of the Manures Acts, dated 10th October, 1905, makes special provision for publication in the *Government Gazette* of *analysis of all samples of manures taken by inspecting officers* of the Laboratory. The analyses *must be published* whether the samples comply with the Acts or otherwise. In addition, any analyses of manures collected by the inspecting officers, after publication in the *Government Gazette*, may be published in or by any newspaper circulating in any part of Victoria without rendering the proprietor, printer, or publisher thereof liable to any action or proceeding in any Court.

It may be confidently anticipated that this new "advertisement" provision of the Manures Acts will exercise an actively deterrent effect on any vendor of manures contemplating illicit personal benefits at the expense of Victorian farmers. It is a pleasure to acknowledge that the, so far, numerous inspections of manures made by the Chemical Branch have proved that infringements of the law are extremely uncommon considering the magnitude of the commercial transactions in artificial fertilizers, and the large values represented thereby. This satisfaction should not allow slack control to supervene. In view of the continuous extension in the application of artificial fertilizers close control of the traffic is alike essential to the financial interests of farmers, honest manufacturers, and honest vendors.

Modern agriculture everywhere tends more and more exclusively to intensive culture, the object being always to raise the maximum from a given area of ground, whether it be in grass, grain, fodder, fruit, or timber. Soils quite exceptionally contain the principal plant foods in proper proportions in forms readily available for plant nutrition. Even if this were the case, current systems of cultivation would tend to rapidly alter the physical condition and also create a deficiency in the soil of one or more of the essential elements of plant foods. On the other hand, most arable soils, all the world over, are more or less deficient in the assimilable forms of one or other of the plant foods, or of those at present relatively little known agencies which render the already existing fertilizing constituents of the soil eligible for plant nutrition. Such soils, owing to their deficiencies, cannot give a normal yield in return for the labour of ordinary cultivation, apart from fluctuating climatic conditions.

Accumulated data gained by scientifically conducted agricultural experimental work during the past 40 years have demonstrated in a most convincing manner the financial advantages to be won by the use of artificial and certain natural fertilizers for correcting soil deficiencies, and replenishing the losses to the soil caused by plant cultivation.

In a highly convenient and concentrated form most artificial and some natural fertilizers supply cultivators with a choice of all necessary plant foods. Used with intelligent judgment and discrimination, having a view to accurately ascertained soil deficiencies and plant needs, the artificial and natural fertilizers enable an increased return from the soil (apart from climatic considerations) to be counted upon with almost absolute certainty at actually minimum expense.

Cultural operations must not, however, be overlooked as an important factor in the production of continuous good returns. Thorough tillage, deep disturbance of the soil, and systematic rotations will always be prominent in maintaining the soil in the special physical condition enabling plant foods to be so assimilated as to assure the maximum fertility.

LIST OF UNIT VALUES OF MANURES IN THE MELBOURNE MARKET DURING THE 1906 SEASON.

1 per cent. of Nitrogen in the form of	Nitrate of Soda Nitrate of Potash	is worth	15	6
1 ,, ,, ,,	Sulphate of Ammonia	,,	14	4
1 ,, ,, ,,	Blood Manure	,,	11	0
1 ,, ,, ,,	Fine Bonedust	,,	11	0
1 ,, ,, ,,	Coarse ,,	,,	9	6

In the mixed manures, such as Phosphate mixture, Bones and Digester Refuse; Blood Bone and Hashmagandy; Dried Blood and Organic Matter; Bone and Wood Ashes; Superphosphate and Gypsum; Bonedust and Gypsum; Bone, &c., Manure—1 per cent. of Nitrogen is valued at 9s. 6d.

If an invoice certificate does not state whether the Nitrogen in the Manure is in the form of Nitrate, or Sulphate, or Blood, or Bones, it is to be assumed to have the value of Bone Nitrogen.

			s.	*d.*
1 per cent. of Water Soluble Phosphoric Acid		is worth	4	6
1 per cent. of Citric Soluble Phosphoric Acid	Thomas Phosphates Nitro Superphosphates Ordinary Superphosphates Guanos	,,	4	0
1 per cent. of Insoluble Phosphoric Acid ...	Thomas Phosphates Nitro Superphosphates Guanos	,,	3	0
1 per cent. of Insoluble Phosphoric Acid in Ordinary Superphosphates		,,	1	0
In a Bonedust—				
1 per cent. of Phosphoric Acid in Fine Bone		,,	4	0
1 ,, ,, ,, ,, Coarse Bone		,,	3	0
1 per cent. of Potash		,,	5	6

List of Unit Values of Manures in the Melbourne Market during the 1906 Season—*continued.*

Description of Manure.	Moisture. Per centage	Nitrogen. Per-centage.	Nitrogen. Estimated Value in One ton of the Manure. £ s. d.	Phosphoric Acid. Per-centage.	Phosphoric Acid. Estimated Value in One ton of the Manure. £ s. d.	Potash. Per-centage.	Potash. Estimated Value in One ton of the Manure. £ s. d.	Estimated Total Value of Manure per ton. £ s. d.	Price asked for Manure per ton Delivered at Local Railway Station. £ s. d.	Where Obtainable.
Mainly Nitrogenous										
Sulphate of Ammonia	..	20.88	14 19 3	..	..	..	..	14 19 3	14 10 0	Cuming, Smith, and Coy., William-street, Melbourne
„	..	20.85	14 18 10	..	..	..	..	14 18 10	15 0 0	Mt. Lyell M. and R. Coy., Queen-street, Melbourne
Nitrate of Soda	..	15.06	11 13 5	..	..	..	..	11 13 5	12 0 0	„ „ „ „
„	..	15.41	11 18 10	..	..	..	..	11 18 10	12 0 0	Cuming, Smith, and Coy., William-street, Melbourne
Blood Manure	22.94	11.29	6 4 2	.76	0 2 3	.15	0 0 9	6 7 2	6 10 0	Jno. Cooke, Collins-street, Melbourne
„	41.38	8.58	4 14 4	.86	0 2 6	.17	0 0 11	4 17 9	7 10 0	W. Angliss and Coy., Footscray
„	5.94	13.09	7 4 0	..	..	..	..	7 4 0	9 0 0	Mt. Lyell M. and R. Coy., Queen-street, Melbourne
Mainly Potassic										
Kainit	..	..	..	..	..	13.52	3 14 4	3 14 4	5 0 0	Cuming, Smith, and Coy., William-street, Melbourne
Potash Nitrate	..	13.25	10 5 4	..	..	47.41	13 0 9	23 6 1	20 0 0	„ „ „ „ „
Potash Chloride	..	..	..	..	..	61.80	16 19 10	16 19 10	13 0 0	„ „ „ „ „
„	..	..	..	.	..	58.46	16 1 6	16 1 6	13 10 0	Renard Fertilizer Coy. Propy. Ltd. „ „
„	..	..	.	.	..	61.62	16 18 0	16 18 0	13 10 0	Mt. Lyell M. and R. Coy., Queen-street, Melbourne
Potash Sulphate	..	..	..		.	51.19	14 1 6	14 1 6	14 10 0	Renard Fertilizer Coy. Propy. Ltd.
„	..	..	.	.	.	52.07	14 6 4	14 6 4	14 10 0	Cuming, Smith, and Coy., William-street, Melbourne
„	..	..	.		..	48.44	13 6 5	13 6 5	14 10 0	Mt. Lyell M. and R. Coy., Queen-street, Melbourne

LIST OF UNIT VALUES OF MANURES IN THE MELBOURNE MARKET DURING THE 1906 SEASON—*continued.*

Description of Manure.	Moisture.	Nitrogen.		Phosphoric Acid.								Estimated Total Value of Manure per ton.	Price asked for Manure per ton Delivered at Local Railway Station.	Where Obtainable
				Water Soluble.		Citrate Soluble.		Insoluble.		Total.				
	Per-cent-age.	Per-cent-age.	Estimated Value in One ton of the Manure.	Per-cent-age.	Estimated Value in One ton of the Manure.	Per-cent-age.	Estimated Value in One ton of the Manure.	Per-cent-age.	Estimated Value in One ton of the Manure.	Per-cent-age.	Estimated Value in One ton of the Manure.			
			£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.	£ s. d.	£ s. d.	
Mainly Phosphoric.—Phosphoric Acid readily Soluble.														
Superphosphate ("Hasell's Jap")	11.22	..	..	20.20	4 10 10	1.62	0 6 5	..	..	21.82	4 17 3	4 17 3	4 7 6	A. H. Hasell, 10-12 Queen-street, Melbourne
„ Standard (Flag brand)	7.85	..	..	18.17	4 1 9	2.78	0 11 1	.63	0 0 7	21.58	4 13 5	4 13 5	4 5 0	Renard Fertilizer Coy. Propy. Ltd., William-street, Melbourne
„ Standard "B" „	5.64	.	..	11.56	2 12 0	2.97	0 11 10	.34	0 0 4	14.87	3 4 2	3 4 2	4 0 0	„ „ „
„ Ordinary ..	5.54	.	..	20.29	4 11 3	1.48	0 5 11	.36	0 0 4	22.13	4 17 6	4 17 6	4 5 0	P. Rohs, Bendigo
„ „ ..	9.56	..	..	17.13	3 17 0	2.27	0 9 0	..	..	19.40	4 6 0	4 6 0	5 0 0	J. Cockbill, Post Office-place, Melbourne
„ Florida ..	4.46	..	..	20.63	4 13 9	1.02	0 4 0	.43	0 0 5	22.08	4 18 2	4 18 2	4 10 0	Cuming, Smith, and Coy., William-street, Melbourne
„ Concentrated ..	13.15	.	..	40.33	9 1 5	4.43	0 17 8	..	..	44.76	9 19 1	9 19 1	12 10 0	„ „ „
„ Malden Is. Guano	3.56	.	.	17.13	3 17 0	3.63	0 14 6	4.00	0 4 0	24.76	4 15 6	4 15 6	5 0 0	„ „ „
„ Wischer's .	10.99	..	..	21.02	4 14 7	.99	0 3 11	..	..	22.01	4 18 5	4 18 6	4 10 0	Wischer and Coy., Market-street, Melbourne
„ Ordinary ..	9.55	..	..	18.65	4 3 11	1.24	0 4 11	1.45	0 1 5	21.34	4 10 3	4 10 3	4 5 0	„ „ „
„ „ ..	6.62	..	..	18.51	4 3 3	2.12	0 8 5	2.00	0 2 0	22.63	4 13 8	4 13 8	4 10 0	Australian Explosives and Chemical Coy., Melbourne
„ 15% ..	6.26	.	..	13.63	3 1 3	2.28	0 9 1	1.61	0 1 7	17.52	3 11 11	3 11 11	3 18 0	„ „ „
„ Special .	9.45	.	.	21.86	4 18 4	2.08	0 8 3	..	..	23.94	5 6 7	5 6 7	4 15 0	Mt. Lyell M. and R. Coy., Queen-street, Melbourne
„ No. 1 ..	8.91	.	..	19.25	4 6 7	1.61	0 6 5	.67	0 0 8	21.53	4 13 8	4 13 8	4 5 0	„ „ „
„ No. 2 ..	9.45	..	..	17.03	3 16 7	1.72	0 6 10	.59	0 0 7	19.32	4 4 0	4 4 0	4 0 0	„ „ „
„ Concentrated ..	12.17	.	..	38.47	8 14 1	5.54	1 2 1	.72	0 0 8	44.73	9 16 10	9 16 10	12 0 0	„ „ „
Containing Nitrogen also.														
Superphosphate, Nitro ..	6.90	1.32	0 12 6	14.17	3 3 9	2.15	0 8 7	1.32	0 4 0	17.64	3 16 4	4 8 10	5 0 0	Australian Explosives and Chemical Coy., Melbourne
„ Bone Nitro ..	6.27	1.63	0 15 6	12.39	2 15 9	3.57	0 14 3	4.73	0 14 2	20.69	4 4 2	4 19 8	5 0 0	Cuming, Smith, and Coy., William-street, Melbourne

List of Unit Values of Manures in the Melbourne Market during the 1906 Season—*continued.*

Description of Manure.	Moisture. Percentage.	Nitrogen. Percentage.	Nitrogen. Estimated Value in One ton of the Manure. £ s. d.	Phosphoric Acid. Water Soluble. Percentage.	Water Soluble. Estimated Value in One ton of the Manure. £ s. d.	Citrate Soluble. Percentage.	Citrate Soluble. Estimated Value in One ton of the Manure. £ s. d.	Insoluble. Percentage.	Insoluble. Estimated Value in One ton of the Manure. £ s. d.	Total. Percentage.	Total. Estimated Value in One ton of the Manure. £ s. d.	Estimated Total Value of Manure per ton. £ s. d.	Price asked for Manure per ton Delivered at Local Railway Station. £ s. d.	Where Obtainable.
Containing Nitrogen also—continued.														
Superphosphate and Bonedust	7.25	1.75	0 16 7	7.13	1 12 1	11.19	2 4 9	3.89	0 11 8	22.21	4 8 6	5 5 1	5 0 0	Cuming, Smith, and Coy., William-street, Melbourne
" "	9.65	.97	0 9 2	13.78	3 2 0	4.55	0 18 2	.81	0 2 5	19.14	4 2 7	4 11 9	5 5 0	J. Cockbill, Post Office-place, Melbourne
" "	10.20	1.00	0 9 6	5.35	1 4 1	13.62	2 14 6	2.88	0 8 8	21.85	4 7 3	4 16 9	5 0 0	Waddell and Coy., Kensington
" " No. 2	8.74	.81	0 7 8	13.07	2 18 10	5.29	1 1 2	2.29	0 6 10	20.55	4 6 10	4 14 6	4 15 0	Mt. Lyell M. and R. Coy., Queen-street, Melbourne
" " Standard	6.56	1.16	0 11 0	12.25	2 15 2	4.38	0 17 6	3.27	0 9 10	19.90	4 2 6	4 13 6	5 0 0	Renard Fertilizer Coy. Propy. Ltd., William-street, Melbourne
" Standard Nitro	6.42	1.37	0 13 0	10.28	2 6 3	5.56	1 2 3	2.95	0 8 10	18.79	3 17 4	4 10 4	5 0 0	" " "
" Nitro ..	9.71	1.60	1 0 0	16.26	3 13 2	2.24	0 9 0	..	..	18.50	4 2 2	5 2 2	5 0 0	Mt. Lyell M. and R. Coy., Queen-street, Melbourne
Phosphoric Acid moderately Soluble.														
Thomas Phosphate, Standard Flag Brand	..	..	..	..	..	13.17	2 12 8	4.33	0 12 11	17.50	3 5 7	3 5 7	4 0 0	Renard Fertilizer Coy. Propy. Ltd., William-street, Melbourne
" (Star Phosphate)	..	..	..	..	..	13.02	2 12 0	4.40	0 13 2	17.42	3 5 2	3 5 2	4 5 0	" " "
"	..	..	..	..	..	11.87	2 7 6	4.63	0 13 10	16.50	3 1 4	3 1 4	4 0 0	Mt. Lyell M. and R. Coy., Queen-street, Melbourne
Phosphoric Acid difficultly Soluble.														
Guano	..	.58	0 5 6	..	..	..	..	..	..	9.45	1 13 4	1 18 10	2 0 0	Garnsworthy and Coy., Williamstown
" (Malden Island) ..	..	..	..	..	..	..	..	..	..	30.70	4 12 1	4 12 1	5 0 0	Cuming, Smith, and Coy., William-street, Melbourne
"	..	..	..	..	..	..	..	..	..	13.07	1 19 2	1 19 2	3 0 0	J. Sinclair, Portarlington

List of Unit Values of Manures in the Melbourne Market during the 1906 Season—*continued.*

Description of Manure.	Moisture. Per-centage.	Nitrogen. Per-centage.	Nitrogen. Estimated Value in One ton of the Manure.	Phosphoric Acid. Per-centage.	Phosphoric Acid. Estimated Value in One ton of the Manure.	Mechanical Condition. Per-centage of Fine Bone.	Mechanical Condition. Per-centage of Coarse Bone.	Mechanical Condition. Nitrogen. Per-centage in Fine Bone.	Mechanical Condition. Nitrogen. Per-centage in Coarse Bone.	Mechanical Condition. Phosphoric Acid. Per-centage in Fine Bone.	Mechanical Condition. Phosphoric Acid. Per-centage in Coarse Bone.	Estimated total Value of Manure per ton.	Price asked for Manure per ton Delivered at Local Railway Station.	Where Obtainable.
			£ s. d.		£ s. d.							£ s. d.	£ s. d	
Containing Phosphoric Acid and Nitrogen.—Phosphoric Acid difficultly Soluble.														
Blood, Bone, and Digester Refuse	7.02	7.55	3 15 6	11.44	1 18 8	30.23	69.77	1.91	5.64	4.40	7.04	5 14 2	5 15 0	Thos. Borthwick and Sons Ltd., Portland
Animal Fertilizer	10.89	6.35	3 2 0	12.81	2 0 9	19.04	80.96	1.15	5.20	2.40	10.41	5 2 9	5 10 0	Newport Freezing Works, Newport
"	4.79	6.70	3 11 2	11.28	1 19 11	54.61	45.39	3.63	3.07	6.00	5.28	5 11 1	5 10 0	Jno. Cooke, Collins-street, Melbourne
" (with Blood)	6.78	7.64	3 17 0	9.03	1 10 7	39.11	60.89	2.91	4.73	3 50	5.53	5 7 7	6 0 0	" " "
Magic Fertilizer	19.23	1.56	0 15 6	14.21	2 7 7	44.98	55.02	.47	1.09	5 01	9.20	3 3 1	4 5 0	Geo. Gardiner, Marshalltown, Geelong
Bonedust, Magic No. 1 ..	11.65	1.79	0 17 8	17.60	2 18 1	32.60	67.80	.53	1.26	5.41	12.19	3 15 9	5 0 0	" " "
" Magic No. 2 ..	13.81	2.08	1 0 6	16.28	2 13 8	37.09	62.91	.52	1.56	4.84	11.44	3 14 2	4 15 0	" " "
" Standard Flag Brand	6.21	4.29	2 3 5	20.85	3 16 1	49.00	51.00	1.79	2.50	10.69	11.13	5 19 6	6 0 0	Renard Fertilizer Coy. Propy. Ltd.
"	8.44	2.11	0 18 6	17.17	2 16 11	36.50	63.50	.17	1.18	5.48	11.69	3 15 5	5 5 0	H. J. Feore and Coy., Richmond
"	19.16	2.18	1 1 6	11.44	1 18 2	38.52	61.18	.52	1.66	3.82	7.62	2 19 8	5 10 0	P. Fitzgerald, East Brighton
"	6.77	4.09	2 1 1	21.60	3 12 5	37.65	62.35	1.51	2.58	7.70	13.90	5 13 6	5 5 0	P. Rohs, Bendigo
"	14.32	3.78	1 18 1	19.15	3 5 2	40.83	59.17	1.47	2.31	7.82	11.33	5 3 3	5 10 0	J. Cockbill, Post Office-place, Melbourne
"	9.51	3.12	1 12 0	19.38	3 9 4	55.36	44.64	1.61	1.51	11.19	8.19	5 1 4	5 15 0	Heinz Bros., Ballarat
"	7.71	2.84	1 8 5	16.52	2 17 0	43.47	56.53	1.00	1.84	7.48	9.04	4 5 5	5 0 0	Pennell Bros., Braybrook
"	10.88	2.30	1 3 0	21.74	3 14 11	36.57	63.43	.80	1.50	9.76	11.98	4 17 11	5 0 0	Waddell and Coy., Kensington
"	7.96	2.42	1 4 0	21.75	3 12 5	37.28	62.72	.68	1.74	7.08	14.67	4 16 5	5 10 0	Cuming, Smith, and Coy., William-street, Melbourne
" Special	6.89	4.52	2 5 2	17.10	2 17 5	35.98	64.02	1.52	3.00	6.14	10.96	5 2 7	6 0 0	" " "
"	6.12	3.63	1 16 11	21.72	3 15 6	48.68	51.32	1.65	1.98	10.42	11.30	5 12 5	5 10 0	Kensington Manufacturing Coy., Kensington
"	8.03	4.08	1 19 10	20.85	3 6 9	25.46	74.54	.72	3.36	4.27	16.58	5 6 7	5 10 0	A. E. Kleiner, Wangaratta
"	6.72	3.45	1 14 0	24.50	4 0 7	31.40	68.60	.85	2.60	7.15	17.35	5 14 7	5 5 0	J. W. Branch, Geelong
"	4.48	3.46	1 15 6	22.98	4 1 9	57.10	42.90	1.75	1.71	12.79	10.19	5 17 3	5 10 0	J. A. Little and Son, Ararat
"	7.65	4.35	2 2 3	20.42	3 4 8	18.59	81.41	.68	3.67	3.38	17.04	5 6 11	5 10 0	Jno. R. Ellsworth, Ballarat
"	6.72	2.62	1 6 3	25.23	4 6 4	42.10	57.90	.95	1.67	10.70	14.53	5 12 7	5 10 0	Executors, Jas. Brown, Hamilton
"	4.42	4.24	2 3 3	21.45	3 15 0	50.17	49.83	1.94	2.30	10.67	10.78	5 18 3	5 5 0	Boyle and Williams, Echuca
"	6.17	3.69	1 16 8	22.45	3 14 0	33.48	66.52	1.09	2.60	6.68	15.77	5 10 8	5 10 0	S. and F. Bugg, Kyneton

List of Unit Values of Manures in the Melbourne Market during the 1906 Season—*continued.*

Description of Manure.	Moisture.	Nitrogen.		Phosphoric Acid.		Mechanical Condition.						Estimated total Value of Manure per ton.	Price asked for Manure per ton Delivered at Local Railway Station.	Where Obtainable
								Nitrogen.		Phosphoric Acid.				
	Percentage.	Percentage.	Estimated Value in One ton of the Manure	Percentage.	Estimated Value in One ton of the Manure.	Percentage of Fine Bone.	Percentage of Coarse Bone.	Percentage in Fine Bone.	Percentage in Coarse Bone.	Percentage in Fine Bone.	Percentage in Coarse Bone.			
			£ s. d.		£ s. d.							£ s. d	£ s. d.	
Containing Phosphoric Acid and Nitrogen.—Phosphoric Acid difficultly Soluble—continued.														
Bonedust	6.06	3.23	1 12 9	21.92	3 18 3	52.45	47.55	1.41	1.82	12.57	9.35	5 11 0	6 0 0	Mt. Lyell M. and R. Coy., Queen-street, Melbourne
"	9.86	3.97	1 18 8	20.65	3 6 0	18.45	81.55	.65	3.32	4.05	16.60	5 4 8	6 0 0	J. R. Jopling, Ballarat
"	8.34	3.72	1 16 10	23.11	4 1 0	49.55	50.45	1.68	2.04	11.77	11.34	5 17 10	6 0 0	C. Sargeant, Warragul
Bone Manure	16.00	2.39	1 3 3	7.41	1 4 1	30.70	69.30	.40	1.99	1.89	5 52	2 7 4	5 0 0	A. W. Redman, Union-street, Brunswick
Bonedust and Blood Fertilizer..	16.78	2 89	1 9 10	16.61	2 18 2	48.27	51.73	1.61	1.28	8 28	8.33	4 8 0	5 0 0	Waddell and Coy., Kensington

List of Unit Values of Manures in the Melbourne Market during the 1906 Season—*continued.*

Description of Manure.	Moisture. Percentage.	Nitrogen. Percentage.	Nitrogen. Estimated Value in One ton of the Manure.	Phosphoric Acid. Water Soluble. Percentage.	Water Soluble. Estimated Value in One ton of the Manure.	Citrate Soluble. Percentage.	Citrate Soluble. Estimated Value in One ton of the Manure	Insoluble. Percentage	Insoluble. Estimated Value in One ton of the Manure.	Total. Percentage.	Total. Estimated Value in One ton of the Manure.	Potash. Percentage.	Potash. Estimated Value in One ton of the Manure.	Estimated Total Value of Manure per ton	Price asked for Manure per ton Delivered at Local Railway Station.	Where Obtainable.
			£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.	£ s. d.	£ s. d.	
Mixed Manures, containing Phosphoric Acid, Nitrogen, and Potash.																
Potato Manure ..	8.17	1.00	0 15 6	8.36	1 17 7	5.36	1 1 5	5.90	0 17 9	19.62	3 16 9	6.52	1 15 11	6 8 2	6 0 0	Cuming, Smith, and Coy., William-street, Melbourne
Orchard and Onion Manure	3.64	1.75	1 7 1	15.57	3 10 1	1.79	0 7 2	.32	0 1 0	17.68	3 18 3	5.74	1 11 7	6 16 11	7 0 0	,, ,,
Grass Manure (Pasture)	4.17	1.72	1 6 8	9.82	2 4 2	6.32	1 5 3	6.86	1 0 7	23.00	4 10 0	2.93	0 16 1	6 12 9	6 0 0	,, ,,
,, (Top Dressing)	4.00	1.57	1 4 3	18.76	4 4 5	1.31	0 5 3	.33	0 [illegible] 0	20.40	4 10 8	.26	0 1 4	5 16 3	6 0 0	,,
Leguminous Manure ..	3.32	..	..	18.23	4 2 0	1.81	0 7 3	.39	0 1 2	20.43	4 10 5	5.64	1 11 0	6 1 5	5 0 0	,, ,,
Horticultural Manure ..	3.06	3.31	2 11 3	11.72	2 12 9	1.84	0 7 4	..	..	13.56	3 0 1	10.99	3 0 5	8 11 9	8 10 0	,, ,,
Pea and Bean Manure	6.92	..	..	11.55	2 12 0	3.32	0 13 3	1.33	0 4 0	16.20	3 9 3	4.00	1 2 0	4 11 3	5 0 0	Australian Explosives and Chemical Coy.
Potato Manure ..	6.47	..	..	16.09	3 12 5	2.81	0 11 3	1.40	0 4 2	20.30	4 7 10	3.12	0 17 2	5 5 0	6 0 0	,, ,,
Bone and Wood Ashes..	11.94	1.75	1 7 1	..	..	5.58	1 2 4	3.84	0 11 6	9.42	1 13 10	.44	0 2 5	3 3 4	4 0 0	A. E. Kleiner, Wangaratta

W. PERCY WILKINSON,
Government Analyst
and
Acting Chemist for Agriculture.

Government Laboratory,
Melbourne, 20th December, 1905.

THE LAMB TRADE.

A. A. Brown, M.B.B.S.

CROSSBRED (LINCOLN MERINO) LAMBS.

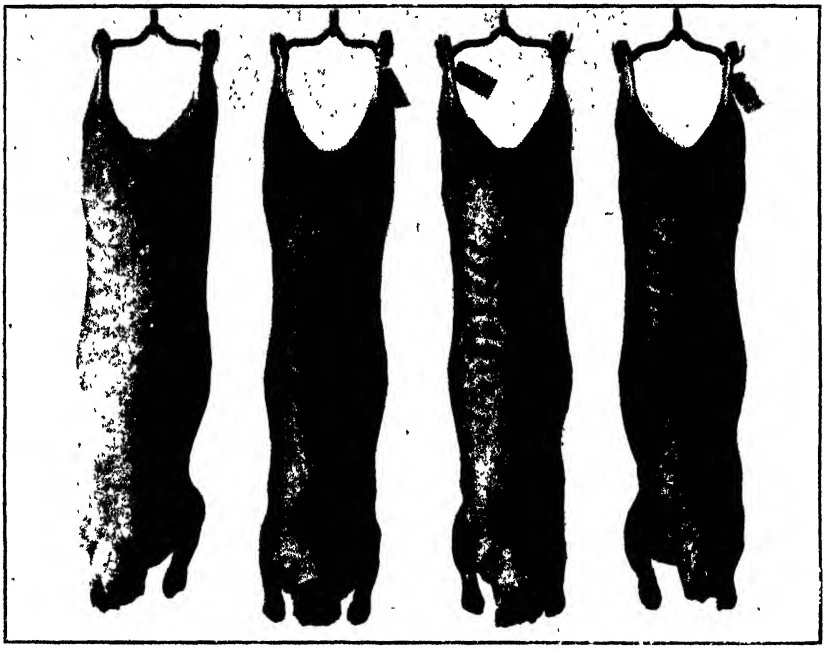
About 7 months old. Killed at Messrs. Wm. Anderson and Co's. Flemington Meat Preserving Works for export.

The industry in Victoria of raising lambs for the meat export trade is capable of enormous expansion if conducted on proper lines. The business is as yet only in its infancy, and when its possibilities are thoroughly appreciated, graziers will bestow something more than passing attention on an industry that affords such a wide scope of operation, and that secures such quick returns.

In the Annual Report of the Department of Agriculture for 1899, I remarked that the time was not far distant when sheep would be specially reared for export. An incentive has now been given to farmers to breed lambs for export by the tempting prices offered for prime lambs of a quality suitable for the trade. Farmers in districts where the railways are of easy access should bestow particular attention on the matter, as, by devoting their energies to the raising of lambs, they might be enabled in time to abandon the drudgery associated with many of the every-day occupations of the farm. Pastoralists now are beginning to devote more care in the selection of breeds to meet both the requirements of the export of meat business, as well as the wool industry. Unfortunately, in many cases, no systematic efforts are being made to top off lambs for market, and I am quite convinced, from my knowledge of the business, that if the system were universally practised, the enhanced returns would more than repay any outlay in the direction of making provision for suitable fodder to fatten the lambs.

With the breaking up of the large estates wider vistas open to view, and with attention concentrated on breeding the proper class of animal for meat export purposes, and the growing of fodder crops to supply the wants of the animals, it is practicable, in those districts where the water supply

is plentiful and certain, to greatly augment the number of sheep depastured, and so permit of an extensive trade in frozen lamb carcases being continuously carried on. With careful attention directed to breeding the best varieties of sheep, and to the proper methods of growing fodder crops to supplement the natural pastures, raising lambs for export will, within a few years, rival the dairying industry in value, and I am optimistic enough to say that it will indeed eventually become the most important industry in the State. The dairying industry is an exacting one to those engaged in it, whereas the lamb industry has more congenial associations and surroundings to those who pursue it. In the raising of lambs for export, the hours of toil would be shorter, labour troubles would not press



SHROPSHIRE-CROSSBRED LAMBS.

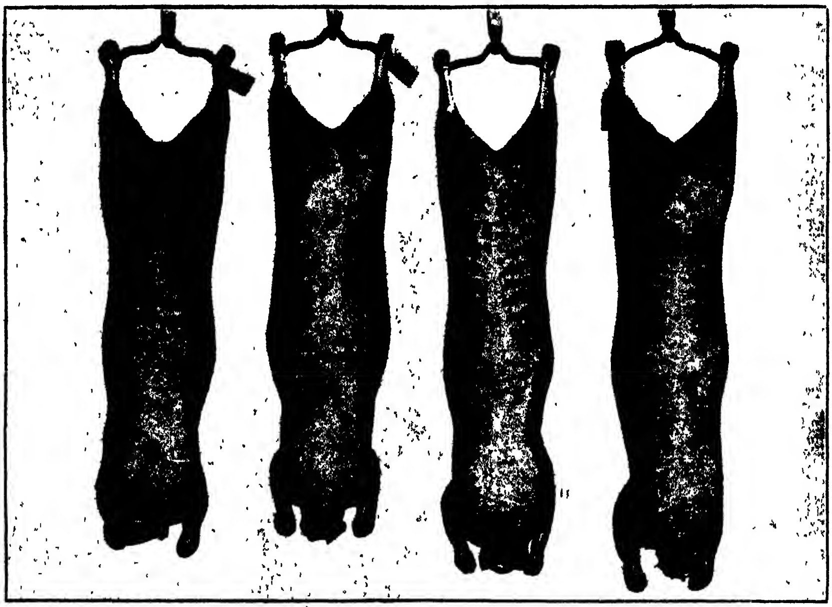
Nine months old. Average weight of carcasses 45 lbs. The lambs were a cross between Shropshire ram and Lincoln-Merino ewe. The carcasses show stout legs and short, thick, plump bodies They are excellent export lambs.

so acutely on those concerned in it, and the conditions of life on the farm would be rendered more attractive and pleasant. The whole secret of the enterprise turning out successfully depends upon making ample provision for supplying fodder continuously to the flock, and method and management circulate around the feeding problem.

Before touching upon the various special aspects surrounding the industry, one naturally asks what is the commodity that the London merchants require to supply the wants of their lamb trade. To meet the purposes of their lamb trade, London merchants want young lambs, direct from the mothers, and this country can supply them when no other country, except the Argentine, can. The Argentine is our most formidable competitor on the London markets, but those interested in the industry, and who have visited the Argentine, declare that we have nothing to fear from that country, because our lambs are generally superior in quality to theirs. In that

country, tape worms and round worms are prolific inhabitants of the intestines of lambs, and when lambs are invaded by these parasites they fail to thrive. The seasons in the Argentine certainly correspond with our own, but, not only are the flocks infested with worms, but scab extensively prevails, so that pastoralists find it impossible to fatten lambs in any quantity. The Argentine, however, is a large exporter of mutton, and in that commodity, perhaps, will prove a powerful enough competitor. Lucerne crops are grown extensively in the Argentine, but are said not to have the nourishing qualities possessed by similar crops grown on Victorian soil.

When the practice of properly feeding lambs is generally established in Victoria, graziers will realize prices equal to what is obtained by New Zealand producers on the London markets. In fact, lambs of Victorian



SHROPSHIRE-CROSSBRED LAMBS.

Under 6 months old Average weight of carcasses 34 lbs. The lambs were a cross between Shropshire ram and Lincoln Merino ewe. Note thick legs and plumpness of carcasses. At this age, or younger, this breed commands the highest prices on the markets.

origin, if properly tended, should command higher prices, since our climate is more genial, and therefore more favorable to the rapid development of the lamb and the cultivation of fodder crops, than that of New Zealand.

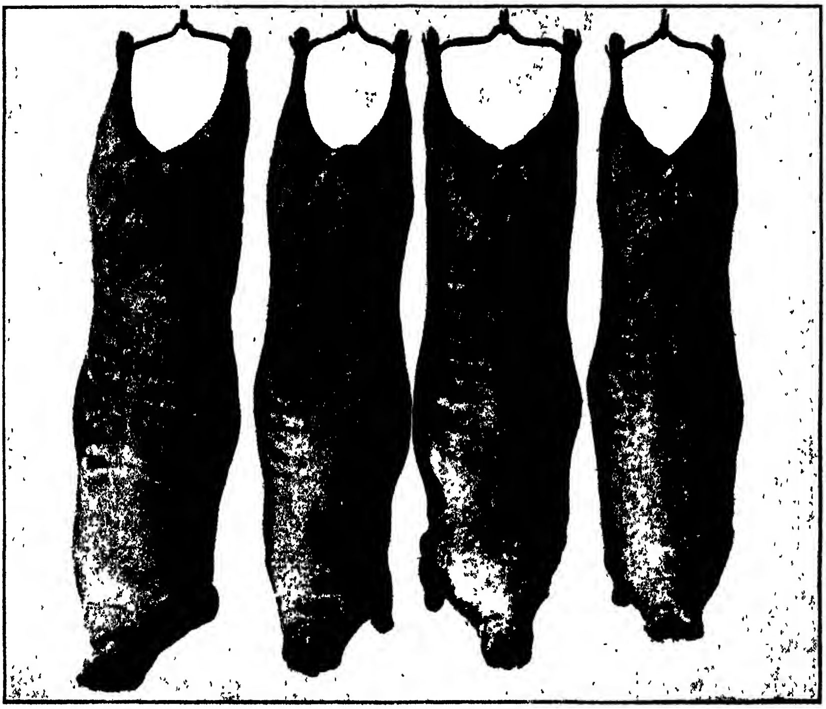
The lamb export season in Victoria usually commences in September, but it may some years begin in August. The lambs exported from Victoria are placed on the London markets in October, November, December, and January. In consequence of seasonal differences, lambs from New Zealand are not placed on London markets till February, March, April, and May. The lambs raised in Britain itself are placed on the market in June, July, and August. It may be interesting to know that Britain, for its extent of country, runs more stock than any other nation over a similar area. In 1903, there were 11,408,560 cattle and 29,658,840 sheep in the United Kingdom, and there were killed for food purposes during that year about 11,432,000 sheep and lambs, the products of the nation. In addition,

there were imported something like 15,810,000 carcasses of mutton and lamb, of which Australia sent 478,037, New Zealand 5,078,651, and the Argentine 5,900,000. Of the Australian proportion, Victoria sent 233,504 It was not until April, 1903, that one of the most terrible droughts that ever devastated Australia broke, so 1903 cannot altogether be taken as a criterion of the Australian trade.

In 1904 there were exported from Victoria—

372,918	lamb carcasses	...	... Value	£291,600
72,134	mutton carcasses	...	,,	65,800
864	beef bodies	...	.. ,,	9,600
18,800	veal carcasses	...	... ,,	31,000
1,708	pork carcasses	...	... ,,	2,660

The total value of the meat export trade for 1904, including all frozen and canned products (beef, mutton, rabbits &c.) amounted to £651,245.



CROSSBRED (LINCOLN-MERINO) EWES.

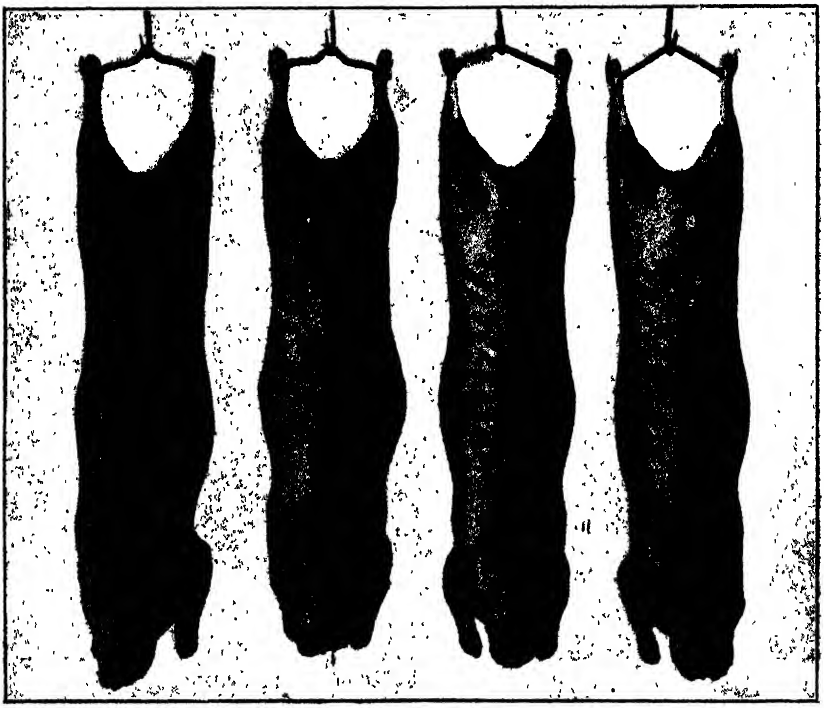
Average weight of carcasses, 95 lbs. Best breed to raise for export of mutton and to cross with the Shropshire for production of export lambs. The carcasses, although indicating the best breed for the purpose, are, however, in this particular case, too heavy for the trade.

GROWTH OF VICTORIAN EXPORTS.

			Mutton.		Lamb.
1897	...	...	...	196,623	
1899	...	..	...	307,065	
1900	...	...	...	257,432	
1904	...	...	72,134	...	372,918
1905	...	...	59,252	...	589,855

In 1904, there were in New Zealand 18,280,806 sheep, of which 9,222,448 were breeding ewes. In that year, New Zealand exported 2,050,542 carcasses of mutton and 1,917,026 carcasses of lamb, and 144,647,376 lbs. of wool. In that country there are 21 freezing works, capable of freezing 4,000,000 sheep per annum, and there is a fleet of steamers specially equipped with refrigerating plants engagd in carrying the cargoes to Great Britain.

The latest returns indicate that there are 10,167,691 sheep in Victoria The State, no doubt, is capable of producing sufficient sheep for its own requirements, but a considerable number of fat and store sheep are annually imported from the Riverina. There were slaughtered for food purposes



CROSSBRED (LINCOLN-MERINO) LAMBS.

Ten months old. Average weight of carcasses, 40 lbs. These carcasses show fairly thick legs, and although plump enough are rather long. They are fairly good export lambs.

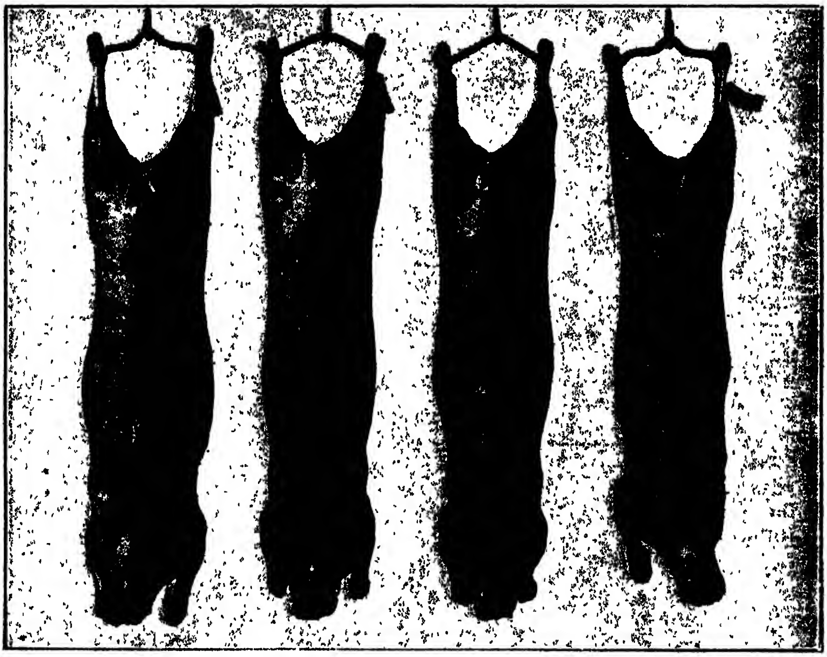
in Victoria during 1904, 2,305,729 sheep and lambs, and there were exported 123,208,133 lbs. of wool, the average production per sheep being about 7½ lbs. The value of the wool exported amounted to £5,452,973.

The increase in the number of sheep in Europe, America, and Australia is not keeping pace with the increase in population, and the number of meat consumers is increasing out of all proportion to the number of sheep being raised. The population in meat-eating countries is steadily increasing, and the increase in the number of sheep is not keeping pace in a corresponding fashion. In Australia the number of sheep will always be a fluctuating quantity, seeing that the country will always be subject to

periodical droughts. These facts indicate to graziers in favoured localities the enormous possibilities of grazing sheep for export. There is, perhaps, at present, more money made in raising sheep in proportion to the money invested than in raising any other species of live stock.

Feeding and Management.

The natural pastures of Victoria, except in certain favoured districts, cannot be continuously relied upon to fulfil the requirements of providing feed for stock, and in order to make the industry successful it is necessary that great attention should be paid to the feeding of lambs. In good seasons grasses and herbage may be abundant, and lambs may then, perhaps, be readily got into prime condition on the natural pastures for



SOUTHDOWN LAMBS (THREE-QUARTER BRED).

About 7 months old. Average weight of carcasses, about 35 lbs. Legs not so thick and carcasses generally not so plump as Shropshire cross. They are, however, good export lambs.

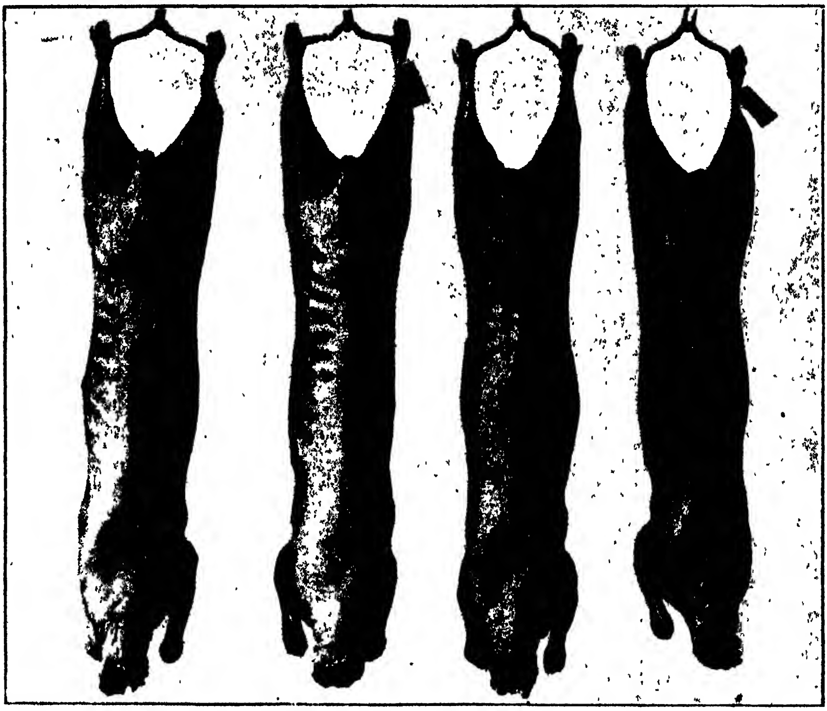
early shipment. But to rely on the natural pastures in Australia to supply the wants of animals is simply courting disaster. Seasons are very unreliable, and it behoves every one embarking in the industry of raising lambs for export to grow fodder crops. From the time the lamb is born until it reaches the slaughter-house, it should not be allowed to receive any check in its development. When, by privations of hunger, a lamb receives a set-back in its career, it is very hard to get it to regain condition, and when it does so it is generally in the *weaner* stage, and its value has depreciated. The lamb must be enabled to thrive from the very start of existence, and become prime quality in the shortest time possible, and this can only be done by supplying abundance of food. In adverse seasons, lambs soon fall away in condition, and, if they have to travel far to the railway, the evil is

accentuated. Where railways are fairly accessible, the industry should flourish. As a matter of fact, the railways play a most important part in making the industry a success. If the farms are very distant from the railways, the lambs fall away much during the journey over the roads to the trucks, and also over the rails to the abattoirs, whereas, if railways are close to the farms, the lambs do not suffer nearly so much damage in transit to the abattoirs.

Every grazier, to be successful, requires to cultivate a portion of his holding, so that plenty of feed may always be available for the requirements of his stock. Even in good seasons, when the natural pastures are amply clothed, it is surprising what excellent results are obtained in feeding lambs on special crops. The feeding of lambs on special crops, in addition to the grasses picked up on the natural pastures, makes all the difference between decided success and indifferent returns in the enterprise. The time has arrived in Australia when proper attention must be bestowed in making provision for feeding stock. On small holdings, where rainfall is reliable, this will, no doubt, be done. Even on large holdings, in districts where rain is uncertain and water scarce at times, ensilage in the good seasons should be made from the natural grasses and sown crops, and conserved for times of scarcity. The conservation of fodder is one of the most important factors in connexion with the continuance of the industry. To insure continuous success, something more than the natural grasses are required. True enough, there may be seasons when lambs can be fattened rapidly on natural pastures, but such seasons are the exception, and not the rule. In indifferent and poor seasons, lambs cannot be properly fattened on the natural pastures, and so artificial fodder is an essential factor in getting them into prime condition. Suitable forage crops should be grown to supplement the feed derived from the natural pastures, and, in all districts of the State where the soil is suitable and water available, either from rain supply or irrigation methods, lucerne can always be grown, and lucerne is good feed to top off lambs. Lucerne grows well on river flats, but it also thrives well on uplands. Under irrigation it grows well in Mildura, and the breeding of lambs for export is an industry that can be profitably combined with fruit-growing there. In Mildura, leguminous crops, for the purpose of enriching the soil with nitrogen compounds, are now being generally grown, and the crops should be availed of to the best advan age to meet both the requirements of the orchard and the feeding of stock. By feeding the crops to stock, and allowing the stock, when conditions are favorable, to graze over the ground, then, for all practical purposes, manurial requirements are fulfilled. By putting the forage through animals, better and quicker results are achieved than if it were simply allowed to rot on the ground. In going through the animal, rapid transformations take place in the forage, and when it leaves the animal, it is brought close to a form in which it can easily, by certain soil bacteria, be rendered suitable for the requirements of plants. Lucerne in summer and autumn, and rape in winter, are perhaps the best of all fodders to supplement the natural pastures. Rape and lucerne can be grown in almost every part of the State where it is possible to practise with success lamb raising for export. With proper management, excess lucerne could be cut and converted into hay, and lucerne hay could be fed to sheep during winter or bare summers. In certain districts, rape and millet luxuriantly thrive. The rape should be sown in early autumn, particularly in Gippsland and in the Western District, just after the first rains have fallen. By sowing in early autumn,

good feed is available right through the winter, and perhaps no fodder crop tops off lambs better than rape. For summer feed, besides lucerne, maize and amber cane could be grown, and excess growth should be converted into ensilage. Rye and cocksfoot are always good grasses to sow down in districts where rainfall is certain and soil suitable. In topping off lambs, mangels and turnips are also excellent foods.

In lamb raising for export, the growing of fodder crops is an essential condition to insure success. The difference in prices between prime and ordinary lambs points out the advantages of proper feeding. Graziers happily circumstanced as regards rainfall and water supplies, should not hesitate to put down fodder crops. Grasses require regular renewal, and



UNSUITABLE FOR EXPORT REQUIREMENTS.

Lambs 10 months old, of a nondescript breed. Average weight of carcasses, 36 lbs. The carcasses, although animals were well fed, show long thin legs and generally a want of plumpness.

the kinds suitable to particular soils should always be grown. By properly feeding lambs and sending them to market in prime condition, graziers are well repaid the trouble and expense incurred in fetching them up to prime condition by the higher prices commanded for the animals when they are of first quality.

In seasons when forage is plentiful, the excess should be converted, depending upon its character, either into hay or ensilage. All who wish to conduct the industry on approved lines must always have at command plenty of food-stuffs. Surplus grass should be made into ensilage. In the form of ensilage, the juices of the grasses are conserved. Ruminants require juicy foods, and, if ensilage is made, a succulent food is always at

hand to be fed to stock during dry summer months, at which season indeed they require juicy food the most. The making of bush hay, or stack ensilage, is possible in good seasons in all districts. The waste of good pasturage that occurs in seasons of plenty is something astounding. Bush hay, or stack ensilage, if kept for seasons of adversity, would tide many graziers over troublesome periods. During periods of drought, the losses of live stock have been appalling, and, if the surplus grasses of good seasons were converted into bush hay or stack ensilage, the enormous losses that have hitherto ruined many pastoralists would, perhaps, be obviated, or, if not actually obviated, would at least be minimized. Of course, the labour aspect demands consideration, but it would be found profitable to undertake the work, notwithstanding the industrial difficulties to which attention has been drawn.

The appropriate manuring of pastures is a matter that must not be overlooked, if their continued fertility, at a high level, is demanded, and therefore the lands should be lightly dressed annually with superphosphate, bone-dust, or other requisite manure.

It is important to notice that lambs should be marked and castrated early, so as to avoid the check to development that the operations involve. The proper arrangement of the paddocks for the lambs to graze over, so that the flocks can be shifted, say, once a month, from one paddock to another, is expedient. This transference of the flocks from one paddock to another tends to keep the pastures clean.

All methods that will enable the lambs to thrive from the outset of existence and become prime quality in the shortest period possible must be practised.

Sheltering Stock.

Shelter should be provided in all paddocks to protect stock from the inclemency of season. It is a singular fact that few stock-owners make proper provision for sheltering stock. The winds of winter, and, indeed, those occasionally of other seasons, are very cold, and if belts of timber were planted ample shelter would be provided from wind, hail, and rain. Neglect to provide shelter has often entailed serious losses in the flocks. When shorn sheep and young lambs are exposed to cold and wet, mortality may be great. The expense of planting trees is not great, and the increased value of the property well repays the trouble. It is wise to plant trees that will not only afford shelter, but that will serve as fodder in times of scarcity.

The pepper tree and African box thorn will grow in any part of the State, no matter how arid, and make splendid shelter, but stock will not eat the leaves of these trees. The *Pinus Insignis*, once it gets a hold, resists droughts, and makes capital shelter, but it is also uneatable. In districts suitable to their growth, sugar gum or currijong trees should be planted. The leaves of these two trees are edible, but sheep would not eat them so long as other more nutritious fodder abounded. The value of the currijong as a fodder in times of drought is incalculable. To feed stock, the branches should be simply lopped off, and on no account should the trees be felled, for it is a wanton waste to do so. After being denuded of the limbs, the trees quickly recover, and, as a matter of fact, they seem to be invigorated by the trimming to which they have been subjected. The leaves contain considerable quantities of moisture, so the trees are particularly adapted for feeding during drought

periods. It is not to be thought that stock will fatten on currijong like they do on saltbush, but they can be kept alive on it. Stock eat not only the leaves, but the soft parts of the branches as well. Stock effectively sheltered thrive well, and are easily kept in forward condition. Exposure to cold makes great demands on the animal economy. Animal heat is dependent upon the slow combustion of foods ingested, and, if the heat of the body be properly conserved by rugging and sheltering animals, there is less waste of tissue in keeping their fire aglow, and consequently less food is required to keep them in a healthy and prime condition.

(*To be continued.*)

SHROPSHIRE-CROSSBRED LAMBS.

About 6 months old. Killed at Messrs. Wm. Anderson and Co.'s Flemington Meat Preserving Works for export.

GARDEN NOTES.

J. Cronin, Inspector, Vegetation Diseases.

The Carnation.

The garden carnation is a descendant of *Dianthus caryophyllus*, a species indigenous to Britain and parts of Europe. It has been cultivated for many centuries, a record existing of an importation of plants into England from Poland in 1597. The types are numerous, and at various times have been arranged into classes, each denoting some particular arrangement of colour in the flowers, or growth in the plants. The classification adopted in Australia is—(1) the spring blooming or show section, which is again subdivided into self, flake, bizarre, picotee, fancy, and decorative kinds; and (2) the perpetual or tree carnation of semi-shrubby habit, which is divided into show and decorative classes. A show carnation of either section should have broad petals, free from serration, and a long calyx that does not "burst" unevenly. Decoratives, which include most of the best winter blooming varieties as "H. Plumridge," "Peach Blossom," &c., are fringed or serrated at the edges of the petals, and the

calyces often burst at one side. The show carnations are usually stouter in the petals than the perpetuals, and endure heat better, but there is no doubt that the latter are the most suitable for general cultivation, as they flower over a long period, and grow into large plants under proper treatment, producing quantities of blooms suitable for all decorative purposes.

Preparation of Soil and Planting.

The carnation will thrive in any fair garden soil that is well drained. Good drainage is probably the most essential factor in the cultivation of this plant. The soil should be deeply worked and a fair quantity of well-rotted stable manure mixed through it. In heavy, retentive soils the addition of sand, wood ashes, or other material that will make the soil porous, is necessary. In very light, sandy soils add strong loam or clay

DARK FLOWERS. ALL PERPETUAL BLOOMERS.

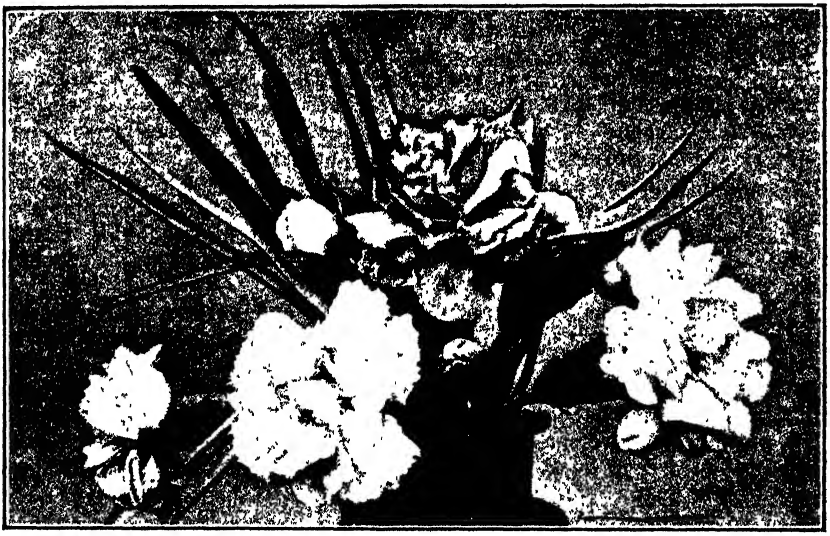
Left:—"Tanner's Scarlet" scarlet; right:—"Tommy Atkins," maroon, flaked red; top:—"H. Plumridge," maroon; bottom:—"Incomparable," buff, edged scarlet.

to the lower spit, and tread the soil firmly before planting. Though carnations will thrive in mixed groups or beds among roses and other plants, special beds should be prepared if fine flowers are desired. A sunny sheltered position is most suitable. Narrow beds that will accommodate two or three rows of plants, about 3 feet between the rows, are best. The plants may be set 1½ to 2 feet apart in the rows. Such a bed can be easily covered to protect the blooms, if necessary, or may be enclosed with wire netting if rabbits or hares are troublesome. Early autumn is the best time to plant. The ground being warm, the plants soon become established and will flower the following spring.

Pests and Diseases.

Mealy bug is the worst enemy of the carnation grower. It penetrates to the deepest roots, and once established it is impossible to eradicate it. It will spread from plant to plant, and ruin a collection in a very short time. The effect is a general sickly, yellow appearance, and the only remedy, destruction of the plants affected. Caterpillars of various kinds

attack carnations. The most destructive are the larvæ of the Agrotis and other cut worms which inhabit the surface soil in the day-time and feed on the plants at night. The soil should be examined and the caterpillars destroyed. An occasional spraying with Paris green will keep looper and other small caterpillars under. Soot worked into the soil lightly near the plants deters both bug and caterpillar. Carnation "rust" and "spot" are fungi that are occasionally found attacking plants, especially when grown in cold, damp situations. The affected leaves or parts should be removed and burned, and the plants kept as dry as possible. Dusting the plants with lime and sulphur, equal parts of each, or spraying with sulphide of potassium, 1 oz. to 2 gallons of water, is the best means of combating these and other fungi.



LIGHT COLORS.

Left:—"J. Keyston," yellow edged red, spring blooming picotee; right:—"Trojan," white, show carnation; top:—"Mrs. Hamilton," buff flaked rose, perpetual fancy; bottom:—"Princess Alice," white striped cerise, perpetual fancy.

Flower Garden.

Dahlias will need a deal of attention this month. The plants should be kept growing freely, and the growths supported as made. An excessive number of shoots should not be allowed; six or eight, according to the strength of the plants, being sufficient. In thinning, the inside shoots should always be removed. The plants will require a liberal supply of water during dry, hot weather, and the surface of the beds should be stirred occasionally. If the blooms are required for exhibition, an occasional "watering" with liquid manure will be beneficial.

Chrysanthemums grown for large blooms must be regularly attended to. The "crown" buds must be saved on most kinds to get first-rate blooms. This bud usually appears in the point of the shoots during February, surrounded by growth buds. The flower bud is round and occupies the centre of the shoot. All other buds, *i.e.*, growth buds, should be removed with a sharp pointed knife, particular care being taken not

to injure the flower bud. Allow the buds to grow to some extent before applying liquid manure. March is early enough to begin to "feed" plants growing in the open ground.

Roses that have been allowed to grow steadily should now receive a top-dressing of manure and be liberally watered to induce free growth. A profuse autumn flowering will result in the case of the tea and hybrid-tea varieties. Roses are not liable to be attacked by thrips to a great extent in the autumn, but will need to be carefully examined for mildew and aphis. An early dusting with sulphur in the case of the first, or spraying with nicotine in the latter, will save a lot of trouble later.

Early in March is the right time to plant bulbs of Daffodils. The soil should be prepared some time before, and ought to be deeply worked and some well-decayed manure mixed thoroughly to the bottom. This applies to the preparation of ground for bulbs generally. Bulbs of some species may remain in one position undisturbed for several years, but they will not be very satisfactory unless the ground has been properly prepared at planting time. Good drainage is an absolute necessity. Very fine blooms of Anemone "St. Brigid" were exhibited at the metropolitan flower shows last spring. This anemone is not new, but has been greatly improved by cultivation and selection. It will not succeed in light sandy soils, but in strong loams it is one of the best spring blooming plants in cultivation. Anemones and Ranunculus should be planted this month. If they are not planted early they develop their flowers in warm sunshine when they are of little value.

The hoe should be freely used in all beds and borders that have not been mulched. A light dressing of bonedust or superphosphate worked in with the hoe will greatly improve the flowers of Delphiniums, Cannas, and other plants that will bloom during autumn. Seedlings of perennial and early-sown annual plants will need careful shading and watering. They must not be overshaded or the plants will be drawn and weakened. Plenty of air should be admitted, and the shading removed after the heat of the day is past.

Kitchen Garden.

As the ground is cleared of peas, potatoes, and other crops, manure should be liberally applied and worked in, so as to be prepared for the planting and sowing of various vegetables for winter use. Next month a deal of ground will need to be ready for planting if a succession is to be maintained. Beds, too, will be required for the sowing of seeds of cabbage, cauliflower, &c., from which plants will be available for late planting. In a garden where vegetables are to be produced for an ordinary household, frequent sowings and plantings are necessary. In short, it is largely perpetual preparation, sowing, and planting. Rotation should be observed as far as possible. The ground should be kept well cultivated between young growing plants. Thin out well when necessary. A few good specimens of any given vegetable are preferable to a cart-load of rubbish, and are easily produced if fair root room and plant food are allowed.

Seeds of French bean and pea may be sown early. Cabbage and cauliflower (early and late varieties), turnip, lettuce, and radish seed should also be sown. Plantings should be made from former sowings of cabbage, cauliflower, and celery, taking advantage of cool or moist weather for the purpose.

ROSES—INSECT ENEMIES.

(Continued from page 61.)

C. French, F.L.S., F.E.S., Government Entomologist.

WHITE SCALE (DIASPIS ROSÆ).

A white scale insect infesting the rose, raspberry, blackberry, currant, and other members of the same orders of plants. Male, winged; colour, light amber with dark, irregular markings, wings white. Female, wingless, eggs red colour, form oval, and from twenty to fifty under each scale. This serious pest of the rose is one which, if not well looked after, will not only render the plant unsightly, but will kill the latter outright, so that, as in the case of most of our insect troubles, the spray pump must be kept going. Upon the first indications of the presence of this scale, cut the plant as hard back as possible for the time of the year. Get a nailbrush or something of the kind, and after having burned the prunings, proceed to scrub the thicker shoots, using either a resin compound, kerosene emulsion, or even nicotine and soap boiled up together, and with this give the woody parts a hard scrubbing. For the weaker shoots, spray with a well-diluted resin compound or soaperine. If the plant be badly affected, take it carefully up during the months of either June or July, cut it back, then immerse the whole plant for 24 hours in a solution of tobacco water. Give the plant stems another good scrubbing, and after disinfecting the soil with some lime, or, better still, muriate of potash, replace the plant, and watch it carefully for a time. The white scale is not easy to stamp out, the great secret of success being to constantly watch the plant, and if the slightest traces of the scale be visible, act promptly.

LOOPER CATERPILLARS (GEOMETRID MOTHS, SEVERAL SPECIES).

The so-called "loopers" are larvæ of small moths, the name of looper having been given to the caterpillars on account of their looper-like attitude when in motion. The female moth deposits her eggs upon the young bud of the rose blossom, and, when hatched, the tiny grub at once commences to bore into the bud. If not at once noticed, the blooms so attacked are done for. The geometers belong to a group of Lepidoptera largely represented in Australia, and included amongst them are many of the worst of our "leaf-roller" pests so well-known to the rose-grower. Spray with either white hellebore, weak Paris-green, or nicotine.

RED SPIDER (TETRANYCHUS TELARIUS).

This well-known pest of growers is not, strictly speaking, an insect, as it belongs to the great group of acarids or mites. Still, I have considered it of sufficient importance to include in this article. The red spider is one of the most troublesome and, in some cases, one of the most destructive of pests, the eggs remaining both in the soil and on the plants during the whole season. The tiny animals, when full grown, are red in colour, hence their title. Deterrents are here again in evidence. When the foliage is firm, spray with either quassia, hellebore, or a weak kerosene emulsion. When spraying, keep a full strength solution for the soil, as upon examination, especially if the soil be a heavy one, myriads of the tiny beasts are to be found in it, and there remain until the late spring, when they sally

out for their work of destruction. Where it can be judiciously done, keep the hose and syringe going, as once the "spider" tackles the foliage it soon spoils the latter's beauty. The red spider must be kept at in the early stages. If the "web" be once formed it is most difficult to destroy the pest without much injury to the plants themselves. Spimo, a great home remedy for spider on hops, might with advantage be tried here on roses as well as on other plants.

Rutherglen Fly (Nysius sp.).

This is a small but formidable pest of the rose grower. It is one of the tiny species of plant-bugs, and is one of the worst of our all-round insects. The perfect insects are winged, and are to be seen in countless millions. When they settle upon a rose bloom they at once commence to drive their beaks into the petals, and then the whole of the nourishment required to form the perfect flower is sucked out, the buds being left on the plant shrivelled, blackened, and dying. As these insects congregate in rubbish, it is desirable to mulch the roses with grass, and at daybreak remove the mulching bodily, and burn it. The crevices in the soil are also great harboring places for this pest. The soil should, therefore, be sprayed with a strong (1 in 8) kerosene emulsion. When the pest makes its appearance it must be tackled at once, and always either in the morning, before the sun gains power, or after dusk. In the case of roses, it will be difficult to use any material strong enough to kill the insects without damaging the tender foliage of the rose. Smoke fires, although successful, is but a half-hearted way of dealing with the pest, for instead of destroying the insects, you drive them on to your neighbour's property, where they hibernate until the following season. The Rutherglen fly is a hard nut to crack, and will look at the ordinary treatment meted out to insect pests as merely in the light of a huge joke, and will even thrive upon a spraying with undiluted fusel oil. I find, however, that the beast does not like either quassia chips or pyrethrum insecticides, so I would recommend these materials as worthy of a trial.

Light Brown Apple Moth (Cacæcia Responsana).

This small but very destructive moth is next to the codlin, our most dangerous insect pest of the apple grower. The perfect insect is yellowish brown, the grubs being not unlike those of the codlin moth. As in the former species alluded to, the eggs are deposited upon the face, also in the folds of the rose petals, and the grub, when hatched, eats into the bud, thereby causing it either to fall off the tree or is otherwise rendered useless. In the case of this pest, deterrents should be used, and for this purpose the pyrethrum insecticides dusted on the young flower buds are very useful. Occasional sprayings with a weak (1 in 20) kerosene emulsion has also been used by many with much success. This moth frequently deposits its eggs about dusk and early in the morning, and, owing to the great damage it does, is well worth watching. I have seen a dozen or more buds ruined in a single night, and, as the trouble is not at once noticeable, it will be seen that careful observation and prompt treatment are necessary to attain success.

Mealy Bug (Dactylopius).

The "Mealy Bug" of gardeners is a great pest, especially as it attacks the roots as well as the branches of the plant, and will be quite at home

in soil of any kind, especially heavy soil. This pest is more troublesome to persons who force roses, either in pots or in tubs. The bug does not appear to do much harm to roses when they are planted out of doors. When this insect appears upon the plant above ground, spray with kerosene emulsion, and in spraying for this pest especially, the liquid must be forced on to the plant with as much force as is consistent with the constitution of the rose to be treated. When the bug is on the root of the plant, disinfect with either bisulphide of carbon placed in the soil, by means of an "injector," or sulphate of iron. In planting roses on old and used land, great care must be taken to treat the soil before planting with some muriate of potash, which is almost a specific against peach aphis when at the roots.

CUT WORMS (EUPLEXIA NIGERRIMA AND OTHERS).

This pest, the name of which I here give, is a terrible pest in rose gardens, the habits of the parent mother being mostly similar to that of the preceding species. The larvæ or grubs are of a dirty greenish brown colour, and are fairly active when at their work of destruction. This grub is a most voracious feeder, and will ruin a large number of rose buds in a very short space of time. It will also attack the leaves. The moth of the species here named is black, with a few white markings. We have reared it from the rose and the carnation buds. Other noctuid moth grubs will also tackle the rose, but this is, I fancy, the worst species for florists' flowers. Spray with white hellebore or nicotine. A good plan is to mix bran, arsenic, and treacle together into a paste, and at dusk lay pieces here and there amongst the plants. *Formulâ*: 50 lbs. bran, 12 lbs. arsenic, 6 lbs. treacle.

STICK-CASE MOTHS (METURA AND ENTOMETA).

These insects, whilst in the larval state, are a great trouble to growers. A very few of the grubs, with their singular stick nest, will soon make short work of the foliage of a rose or any other plant which they select for attack. The perfect insect is a small moth. The female is quite destitute of wings. It both makes and inhabits the case above mentioned. The males, although common, are but rarely seen, and are best captured by means of placing a female under a wire meat cover, or a sieve, and in this way they are easily attracted. As an illustration, I may say that for nearly 50 years I have been collecting insects, and have only taken two male specimens of these moths in the ordinary way. Fortunately, these grubs are easily killed, and a few applications usually suffice for the purpose. Take 1 lb. Paris green (paste form is the easiest), 4 lb. lime, mix and dilute for most plants, say, 1 gallon of the mixture to 160 gallons of water. The grubs, being leaf-eaters, are at once poisoned by the material sprayed on to the plants affected. In the case of roses, it is seldom that the grub attacks the foliage until the latter is well ripened, so that the mixture can be used at a fairly strong rate. There are a few other, and smaller, stick-case insects which attack the rose, but these are not sufficiently numerous to do any considerable damage.

JASSID (JASSIDÆ).

We now come to a tiny green cicada-looking beast, which, for its size, bids fair to become one of the rose-growers' worst pests; at least, when the plants are in bloom. This insect makes its appearance in the hottest weather, and, like the "Rutherglen fly," simply swarms on the leaves as

well as on the blooms. Comparatively speaking, this insect is of recent introduction as a garden pest, although it is supposed to be a native of this State. The group to which this insect is allied contains some of the most extraordinary forms of all insect life. Let us hope that this beast may soon take its departure. Deterrents in the way of quassia, hellebore, emulsions of all kinds, and also care as to the manure used, will have to be adopted. Trapping should be done soon after daylight, or after the sun has lost its power.

THE ORCHARD.

James Lang, Harcourt.

January has been unusually dry, and the fruit trees are beginning to show signs of suffering from want of moisture. Where there is a good supply of water available, and the orchard has been irrigated, the trees and fruit are looking well. Through the lateness of the season, fruit is not as large as is usually the case in January, and will be from three weeks to a month later in maturing. This will have to be borne in mind when marketing the fruit, especially for oversea markets; if picked in an immature state, the fruit soon shrivels.

The apple crop in many districts of the State is very light, and orchardists are apt to neglect the necessary spraying for Codlin moth, but whether the crop is light or heavy, the moth will have its share, unless kept in check by spraying. Where only a few apples are on a tree it is perhaps better to pick them off, rather than expend labour in spraying; the trees that have a good crop can then be better looked after. Bandages also should be examined every ten days or so in the dry districts, as the grub, after leaving the apple, soon enters the chrysalis stage, and the second brood of moths appears.

Strawberry plantations also should be looked over, and if the runners are not required for next season they should be cut off. In selecting runners for planting, it is advisable to take them from plants that fruit well, rather than indiscriminately from the bed. There are strains in plants the same as in animals, and it should always be the aim of the orchardist to propagate only from those trees or plants that are of a good fruit-bearing strain.

February is the best month for budding fruit trees. If bark does not rise freely, give the stocks a good soaking of water. This will cause the bark to rise, and make the operation a success.

It is much to be regretted that a uniform case Act has not yet been passed by Parliament. It is nothing less than a scandal to the fruit-growers that such a state of things in regard to fruit cases should continue for so long. The matter has been under the consideration of the Central Fruit-growers' Association for some years, and, so far, nothing has been done. It is difficult to say how many different sizes of fruit cases come into the market at the present time, but the number is very great, to the manifest loss of the fruit-grower. The buyer, knowing the difference in the size of cases, will take good care to be on the safe side in estimating the weight of the contents, and will only pay accordingly. If uniform cases of a bushel capacity only were allowed to be used, the buyers would know exactly the weight of the contents.

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REPORT ON THE HARVEST RETURNS OF THE WHEAT AND OAT VARIETIES.

NORTHERN EXPERIMENTAL FIELDS, SEASON 1905.

F. E. Lee, Agricultural Superintendent

By no means the least interesting and useful of the tests included in the Northern experimental fields during the past season is the section devoted exclusively to the trials of new and improved varieties of wheat and oats. Even the most casual observer must have been struck with the fact that some wheats show a preference to particular types of soil, some localities are best suited by early ripening varieties, other localities, again, are particularly fitted for the production of wheats of special kinds.

Under the circumstances which prevail at present there is unfortunately, far too little attention paid to the importance of maintaining seed wheat true to name and type.

Wheat, like any other seed, easily retrogrades—that is to say, loses those characteristics of grain and straw which distinguish it from other varieties. As a natural consequence, unless a change of seed is resorted to every few years, the same wheat constantly sown on the same land becomes more liable to disease and less able to withstand rigorous climatic extremes. The grading of seed is a matter that cannot be too strongly urged if the vigour and vitality of the plant is to be maintained. Grading is, after all, only another aspect of the "survival of the fittest," and it is logical that only those seeds should be sown which are best fitted to reproduce their species. The ever increasing confusion of nomenclature in wheats, engenders a danger which cannot be ignored, and the varieties grown on these experimental fields, will serve the very useful purpose of familiarizing farmers with the different appearance and habits of growth of varieties hitherto unknown to them.

Observation sheets were forwarded to each farmer with the request that the most striking features of each variety might be recorded during the whole of the growing and ripening period. Where these notes have been faithfully kept, the accumulated data will be of great service in the future.

HARVEST RETURNS OF WHEAT AND OAT VARIETIES

WHEAT

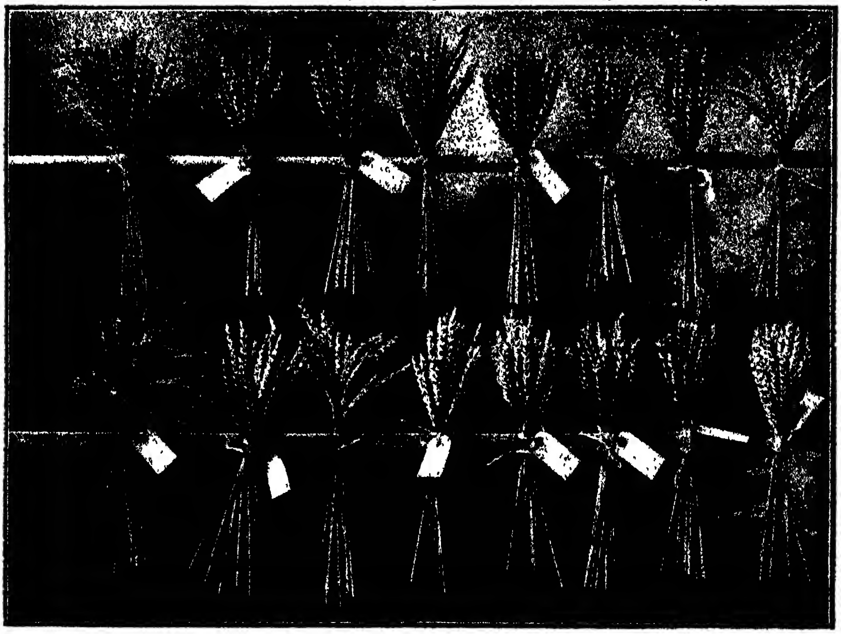
	Waddy 58	Majestic 59	Bearded Innomerata 60	Boomerang 61	Silver King 62	Terkin 63	Fan 64	Smart's Pioneer 65	Steer's Early Purple Straw 66	King's Early 67	Petatz Surprise 68	Gluyas 69	Warrick 70	Marshall's No. 3 71	Newman's 72	Leake's Rust Proof 73	John Brown 74	Bobs 75	Cumberland 76	Tarragon 77
MALLEE AND MALLEE FRINGE																				
Innes, D. B., Rainbow	7 0	15 0	12 2	9 2	15 0	7 8	18 8	11 1	15 0	14 0	12 2	15 6	10 4	12 1	12 6	10 0	13 0	9 5	10 5	19 6
Allen, Jas., Willenabrina	6 6	9 0	8 4	7 0	14 4	7 6	8 8	7 4	8 2	7 8	6 4	8 8	4 8	8 6	7 6	10 0	9 4	7 5	5 0	7 2
Witney, J. B., Jeparit	3 3	6 0	6 3	5 2	8 5	3 3	4 3	6 6	7 2	5 5	4 3	6 5	5 5	8 3	7 1	6 0	5 0	3 5	6 5	5 9
Milbourne, J., Warracknabeal	6 6	16 3	15 1		16 6		14 6	13 0	11 5	14 6	12 3	20 3		16 6	13 8	13 0	15 0	9 6	11 3	13 6
Bennett, J., Warracknabeal	3 4	9 6	5 1	5 8	10 0	4 0	7 6	4 6	1 8	3 8	4 0	6 0	4 1	5 3	5 8	4 0	7 6	7 3	8 0	8 5
Lavery, B., Watchem	6 3	12 6	9 0	9 7	13 3	6 6	11 8	12 3	11 8	10 1	8 3	7 8	6 6	11 1	10 0	10 1	12 0	11 1	13 6	12 6
Mudge, J., Sea Lake	7 8	10 0	11 1	8 6	15 0	8 6	17 0	11 3	7 6	14 3	13 0	11 6	9 3	10 5	10 8	10 6	13 1	11 6	11 0	12 3
Barber, A., Wycheproof	10 0	10 3	11 6	14 1	15 0	9 6	16 0	12 0	13 3	14 3	11 0	14 1	12 5	15 0	14 0	12 3	12 8	11 3	13 2	13 0
Williamson, W., Boort	9 0	9 5	10 3	10 6	15 6	8 8	13 5	9 6	12 5	11 3	9 6	8 8	8 8	12 3	13 1	10 1	16 8	9 2	13 6	14 5
Average yield per acre	7 5	10 3	9 6	8 7	14 1	9 2	12 4	9 7	9 8	10 9	9 0	11 0	7 7	11 0	10 4	9 5	11 6	8 9	10 3	11 9
WIMMERA DISTRICT																				
Peery, J., Dimboola	8 6	18 1	15 5	12 6	24 8	11 3	14 3	13 3	13 0	18 1	9 8	13 0	10 1	20 3	16 8	18 8	19 6	12 0	14 3	19 8
Gibbins, E., Wail	10 0	18 0	14 3	14 1	21 8	11 1	16 8	13 6	13 5	14 0	12 6	13 8	12 5	16 6	14 3	14 8	18 8	14 6	14 3	19 8
Nowatna, C., Jung	6 6	17 1	11 5	11 6	17 6	9 1	16 6	12 6	13 0	12 6	11 5	8 5	8 0	11 8	12 5	11 5	19 5	16 0	14 0	28 5
Pepper, Paul, Colomby	6 3	16 1	7 8	6 1	20 0	8 0	10 3	10 5	7 5	7 1	7 5	9 6	9 1	12 0	8 8	10 6	20 6	19 1	19 1	25 3
Boyd, A., Minyip	7 8	10 6	8 0	7 0	11 6	5 6	10 0	7 8	7 6	7 6	8 5	9 6	5 0	11 0	8 0	6 3	13 3	9 6	6 8	12 3
Hutchings, A., Lubeck	10 3	14 6	11 6	14 6	14 3	11 3	11 0	11 6	10 3	12 3	11 3	9 6	8 8	12 6	10 6	9 6	13 6	9 3	11 0	15 6
Average yield per acre	8 2	15 7	11 4	11 0	18 3	9 4	13 1	11 5	10 8	11 1	10 2	10 6	8 8	14 0	11 8	11 7	17 5	13 4	13 2	20 2
NORTHERN AND NORTH EASTERN																				
Sproat, W., Donald	12 7	20 6	7 0	15 5	19 5	15 4	24 8	18 4	14 7	20 5	14 9	15 6	16 8	18 1	18 0	10 1	15 3	25 5	19 5	20 0
Pollard, H., Glenloth	4 2	7 6	5 0	4 3	8 3	3 6	7 0	6 3	6 8	2 4	4 3	3 4	3 4	8 1	8 0	7 8	3 0	2 3	7 0	9 4
Nixon Bros., Eddington	7 0	16 1	9 5	7 5	17 8	6 8	14 3	12 8	8 3	8 8	9 5	6 1	5 5	8 3	4 0	6 1	15 1	17 5	18 8	21 6
Howard, J., Bet Bet	5 0	9 6	3 3	5 5	8 8	5 0	5 0	8 0	2 0	3 8	4 6	5 6	4 0	6 0	4 6	3 3	11 6	11 5	9 0	11 0
Hunter Bros., Elmore	9 3	21 3	11 6	14 3	26 3	12 0	16 0	19 0	11 6	14 0	12 3	13 0	14 6	18 0	13 0	14 3	19 0	14 3	18 8	17 6
Bray, W., Morrigum	10 0	19 6	17 3	12 0	24 3	7 6	13 0	14 6	15 3	19 3	13 6	16 6	16 0	25 3	19 0	19 3	21 6	18 0	22 3	26 0
Sharp, I. R., Goorambat	10 5	25 3	16 1	13 5	29 8	12 1	16 0	16 8	14 5	16 1	16 5	14 6	17 0	24 8	18 1	24 5	24 8	22 6	17 1	31 1
Average yield per acre	8 3	17 1	8 0	10 3	19 2	8 9	13 7	13 7	10 4	12 1	10 8	10 7	11 0	14 8	12 1	12 2	15 7	18 8	15 3	20 6
Average yield for whole State	7 6	14 2	10 4	9 9	16 7	8 4	13 0	11 5	10 [illegible]	11 2	9 9	10 8	9 1	13 0	11 3	11 0	14 5	12 4	12 7	16 6

Northern Experimental Plots, Season 1905.

Varieties																		Oat Varieties						
Frampton	Dart's Imperial	Manitoba.	Improved Steinwedel	Steinwedel.	Nut Cut	White Tuscan	Outpost	Ranji	Farmer's Friend	Jade.	Federation	Schneider	Hudson's Early Purple Straw	Australian Talavera	Tardent's Blue	Sussex	Kubanka	Algerian	Tartarian	Dun	Tasmanian Giant	Stout White.	Hopton	Black Norwegian.
78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	98	99	100	101	102	103	104
14 0	17 6	11 8	11 6	14 6	16 6	14 3	15 3	4 3	14 8	17 0	14 6	13 1	17 3	12 6	12 3	15 8	10 8	11 4	12 6	9 6	21 0	14 0	13 2	12 0
10 0	11 8	8 2	6 6	5 8	6 0	11 0	7 2	4 2	11 2	12 6	10 6	10 0	10 2	10 6	10 2	10 4	8 0	18 5	10 0	10 5	13 0	9 7	9 0	6 5
[illegible] 9	8 0	5 1	7 2	4 1	5 8	6 8	6 6	2 5	4 6	8 4	7 5	6 3	6 6	7 8	5 0	6 6	3 8	28 3	28 5	25 5	21 0	21 0	21 0	18 0
17 6	17 6	13 0	17 6	14 0	12 8	13 0	8 6	8 0	12 3	14 6	14 3	9 0	10 1	12 0	13 0	16 3	10 3	27 5	18 0	20 5	27 5	23 0	19 0	18 5
7 5	9 6	6 3	10 1	9 6	9 6	9 6	4 5	4 5	4 3	10 0	12 0	9 3	11 6	8 8	7 7	10 3	0 0	16 2	15 2	16 0	21 2	16 0	18 5	18 0
13 1	16 8	12 0	16 1	13 4	13 7	12 5	5 3	7 5	12 0	20 5	19 1	13 0	17 0	14 3	14 6	16 7	13 0	21 2	10 2	7 5	13 8	10 0	7 7	8 5
13 6	17 6	8 1	13 6	13 6	14 3	15 5	13 5	7 6	16 0	19 8	16 1	14 3	16 3	14 0	9 5	13 3	12 5	21 2	5 0	5 5	6 0	9 5	6 2	6 5
13 6	13 1	9 6	17 1	14 2	17 8	16 3	15 6	12 0	12 3	17 3	18 5	13 0	16 6	17 1	12 3	15 5	14 6	31 0	16 0	17 5	24 0	20 2	18 5	17 5
1[illegible] 3	13 0	7 3	20 5	20 6	19 5	11 6	13 1	10 0	13 1	19 6	19 5	16 1	16 3	15 1	13 8	15 9	11 1	17 5	15 1	10 3	21 7	16 5	14 7	11 7
1[illegible] 4	11 5	9 0	13 3	12 2	12 9	12 2	9 9	6 5	11 1	15 5	14 7	11 5	13 5	12 4	10 9	13 4	10 0	21 4	14 5	13 6	18 8	15 5	14 2	11 9
[illegible] 8	20 3	14 0	18 8	12 8	17 6	23 3	14 1	9 1	19 8	21 8	28 5	14 0	20 8	18 3	16 1	21 1	14 8	31 0	22 0	18 0	30 7	25 0	18 0	16 2
21 3	23 3	18 3	19 1	20 1	12 8	24 0	18 6	10 1	19 5	29 3	24 3	14 6	21 5	20 1	15 1	21 3	15 8	25 0	23 0	21 0	26 0	26 2	9 5	16 5
19 [illegible]	26 6	18 1	20 8	17 5	18 3	20 6	11 3	7 6	10 8	24 8	26 8	16 3	23 3	22 5	17 1	21 3	17 5	24 5	26 7	28 5	45 5	36 2	30 2	25 2
[illegible]	23 6	16 8	19 1	14 6	15 5	24 1	9 6	8 0	16 1	24 1	25 8	14 5	22 0	21 8	18 5	24 5	18 1	37 7	25 7	28 2	44 2	44 2	34 2	30 5
14 6	15 0	13 0	15 8	15 3	15 1	15 0	8 0	5 3	11 0	15 0	14 3	11 8	16 3	14 3	13 8	17 3	16 6	25 7	21 5	26 1	26 0	25 0	23 5	25 0
[illegible] 3	18 3	11 0	20 0	15 6	15 0	17 0	6 0	10 6	12 0	17 6	13 6	9 6	14 6	12 3	11 6	16 0	8 3	30 5	28 5	35 5	38 5	32 7	23 0	18 5
19 1	21 1	15 2	18 9	15 9	15 7	20 7	10 4	8 4	14 9	22 2	21 8	13 4	19 7	18 2	15 3	20 2	15 0	30 5	24 6	26 2	35 1	31 5	23 0	21 9
17 [illegible]	19 7	14 7	21 1	18 5	19 1	19 5	11 5	7 5	10 5	19 1	21 5	17 7	22 8	19 6	14 7	21 0	14 6	36 5	12 2	12 0	20 2	22 5	18 8	18 5
7 0	9 1	8 4	12 3	9 4	8 3	9 2	4 6	5 0	8 6	11 1	11 2	8 0	8 9	8 1	8 1	11 7	5 4	20 0	11 5	11 5	17 6	14 0	16 8	16 3
18 3	22 [illegible]	18 6	18 3	16 6	16 6	22 5	11 6	5 8	16 0	24 0	24 0	16 0	21 6	18 3	15 6	22 3	1[illegible] 6	20 0	32 7	29 0	31 5	33 2	28 2	31 5
6 8	11 1	9 6	15 0	6 5	11 3	11 6	3 3	3 3	4 3	12 3	13 0	6 0	12 0	11 8	9 6	12 6	8 3	16 5	10 5	17 5	20 5	22 5	19 0	20 5
18 0	23 3	14 6	18 0	19 3	21 3	21 0	12 3	14 0	16 6	23 1	25 6	16 0	18 6	17 6	14 6	18 0	11 5	52 0	17 4	17 1	42 0	30 6	30 0	18 0
21 0	28 3	20 8	26 8	26 8	22 8	21 6	22 0	10 0	18 8	28 5	28 0	19 0	27 0	22 0	18 0	27 6	18 0	42 5	49 0	20 0	55 5	52 0	49 0	49 0
31 0	30 3	28 3	18 8	9 1	9 0	29 3	15 6	6 0	18 8	33 1	34 0	17 1	25 5	28 1	19 6	28 1	21 1	40 2	30 2	45 2	37 2			
15 6	20 6	16 4	18 4	15 1	15 4	19 2	11 5	7 6	18 0	21 6	22 4	18 4	19 4	17 9	14 3	20 1	13 5	32 5	27 5	21 7	32 0	29 1	26 0	25 6
15 7	18 3	13 0	16 5	14 1	14 4	16 8	10 6	7 4	12 9	19 2	19 0	12 9	17 1	15 7	13 2	17 4	12 6	27 4	21 3	19 6	27 4	24 0	20 1	19 1

LOCALITIES FROM WHICH SEED WAS PROCURED.

Sixteen varieties of seed wheat were procured from Roseworthy Agricultural College, South Australia, four from Wagga and eight from Bathurst Experimental Farms, New South Wales; four from Dookie Agricultural College, Victoria; and six other varieties from reliable sources in Melbourne. In every case the variety was guaranteed true to name and type.



For the initial year of the experiment, it was considered, that in order not to rely too much on the experience of other States, and to guard against a possible alteration of the characteristics of each variety, under changed climatic and soil conditions, the best course to pursue was to keep each group together, hence no attempt was purposely made to classify the varieties into their order of ripening. My conception of an experiment is that nothing should be taken for granted, and by following out the course outlined above, the experiment provides in its first year a number of interesting facts which will be a guide for future development in this direction. Some little curiosity has been expressed at the reason why the late and early varieties were not kept separate, which, I trust, this explanation will remove. There is no more convincing proof of the differences which exist between wheat varieties than the spectacle of a number grown side by side with no attempt at classification.

TREATMENT OF THE WHEAT VARIETIES.

All wheat varieties were pickled with sulphate of copper, or "bluestone," before being despatched from Melbourne. Seeding was, at the rate of 50 lbs. per acre. All the varieties received the same manurial dressing, viz.:—Ordinary superphosphate, at the rate of 56 lbs. per acre. On each farm all the varieties were sown the same day. Inequalities of soil were guarded against as far as possible, when the sites of the fields were originally selected. It may be fairly claimed, therefore, that all the varieties on the same field started with equal chances of success, and wherever there is a difference, it is directly traceable to the merits of the varieties themselves.

The above bald statement of the average yields of all varieties throughout the experimental area conveys little meaning unless accompanied by maximum and minimum yields. In order to facilitate easy comparisons, the varieties are set out below in the order of their average yields for all fields:—

No. of Plot.	Variety.	Maximum Yield.	Minimum Yield.	Average Yield.	No. of Plot.	Variety.	Maximum Yield.	Minimum Yield.	Average Yield.
		bush.	bush.	bush.			bush.	bush.	bush.
88	Jade .. .	33·1	8·4	19·2	71	Marshall's No. 3 .	25·3	3·1	13·0
89	Federation . .	34·0	7·5	19·0	64	Fan ..	24·8	4·3	1 30
79	Dart's Imperial .	30·3	8·0	18·3	90	Schneider . ..	19·0	6·0	12·9
94	Sussex .. .	28·1	6·6	17·4	95	Kubanka	21·1	3·8	12·6
91	Hudson's Early Purple Straw	27·0	6·6	17·1	75	Robs	25·5	2·3	12·4
84	White Tuscan	29·3	6·8	16·8	65	Smart's Pioneer .	19·0	4·6	11·5
62	Silver King .	29·8	8·5	16·7	72	Newman's . .	19·0	4·0	11·3
77	Tarragon . .	31·1	5·9	16·6	67	King's Early . ..	20·5	2·4	11·2
81	Improved Steinwedel	26·3	6·6	16·5	73	Leake's Rust Proof .	24·5	3·3	11·0
78	Frampton ..	30·1	6·8	15·7	69	Gluyas	20·3	3·4	10·8
92	Australian Talavera .	28·1	7·8	15·7	85	Outpost	22·0	3·3	10·6
74	John Brown .. .	24·8	3·0	14·5	60	Bearded Innomerata ..	17·3	5·0	10·4
83	Nut Cut . .	22·8	5·8	14·4	66	Steer's Early Purple Straw	15·3	1·8	10·2
50	Majestic .	25·3	6·0	14·2	61	Boomerang . ..	15·5	4·3	9·9
82	Steinwedel . .	26·3	4·1	14·1	68	Petatz Surprise . .	16·5	4·0	9·9
87	Farmer's Friend	19·8	4·3	13·4	70	Warrick.. . ..	17·0	3·4	9·1
93	Tardent's Blue ..	19·6	5·0	13·2	63	Terkin	15·4	3·3	8·4
76	Cumberland .	22·3	5·0	13·2	58	Waddy	12·7	3·3	7·6
80	Manitoba .. .	28·3	5·1	13·0	86	Ranji	14·0	2·5	7·4

One cannot study the maximum yields of each variety in the above list, without becoming convinced that there are any number of new wheats, well worthy of introduction into our Northern grain areas. Admitting that the wheat yields generally throughout the State, this past season, have been exceptionally good everywhere, there is still cause for congratulation in the knowledge that many of the new varieties, tried for the first time on a comprehensive scale, and under a wide range of soil and climatic conditions, have more than realized the happiest anticipations of them. Even the lowest maximum yield, No. 58, Waddy, has shown itself capable of producing over three bags per acre, a result that will be well up to the average of the State, as a whole. Judging by the very numerous inquiries from farmers since the returns of each field have appeared in the district press, there is ample evidence that the merits of some varieties have highly commended themselves, and the results of the first year of the Northern experiments will, without doubt, lead to a considerable expansion in the introduction of new seed.

Petatz Surprise. King's Early. Steer's Early Purple Straw. Smart's Pioneer. Fan. Terkin. Silver King. Boomerang. Bearded Innomerata. Majestic. Waddy.

Dart's Imperial. Frampton. Tarragon. Cumberland. Bobs. John Brown. Leake's Rust Proof. Newman's. Marshall's No 3. Warrick. Gluyas.

Wheat Varieties in the Mallee and Mallee Fringe.

The reader's attention is especially drawn to the average returns of the wheat varieties grown on soils classed as Mallee and Mallee Fringe. From Rainbow to Boort, may be claimed to include representative Mallee soils.

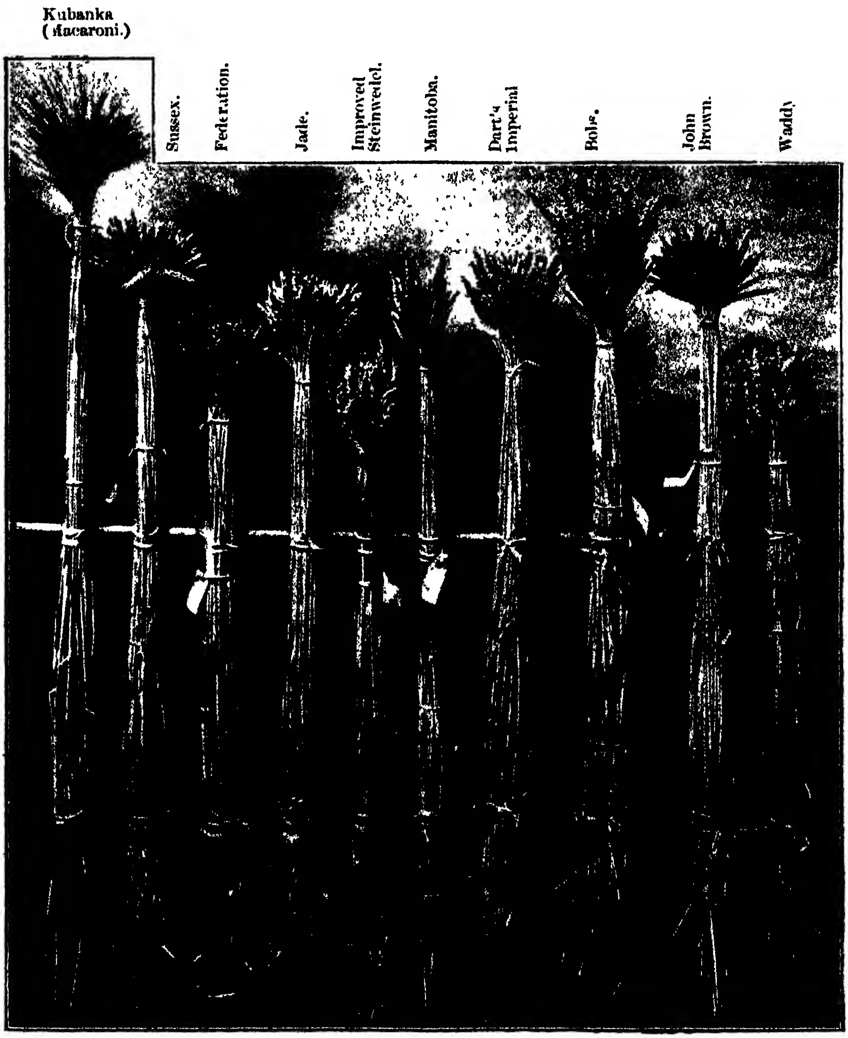
It will be noticed that the yields generally are below the general average for the State, but there are indications, nevertheless, that some varieties notably, Jade, Dart's Imperial, Federation, Improved Steinwedel, Sussex, Hudson's Early Purple Straw, Silver King, Nut Cut, Frampton, and others, are suited by the soil and climatic conditions prevailing in the Mallee.

The varieties which have given the poorest yields, viz. :—Ranji, Waddy, and Warrick, all under two bags per acre, it will be remarked, are also poor in other localities. The results of one year, however, must not be taken to be a proof of the general unsuitability of the varieties named to Northern Victoria. The returns of another season must first be ascertained before any variety can be accurately judged.

Wheat Varieties in the Wimmera District.

Within the term Wimmera is included those fields in North-west Victoria, which are concentrated between the railway lines radiating from Murtoa. It will be noted that the yields generally in these districts are higher than in the Mallee, which was only to be expected, seeing the difference in soil and rainfall. The wheat varieties giving the highest yields are practically the same as in the Mallee, although in some cases there is a difference of over two bags per acre. The oat varieties have all done well.

notably the Tasmanian Giant White, Stout White, and the well-known Algerian. The two former are well suited for grain production, but cannot compare with the Algerian for hay purposes, on account of the coarseness of the straw. Farmers have been much attracted by the plump white oats for feeding purposes.



(The stems were cut equal heights from the ground.)

WHEAT VARIETIES IN THE NORTHERN AND NORTH-EASTERN PLAINS.

Some latitude must be allowed, to embrace Donald and Goorambat under this classification. In general terms the Northern plains include "timber" and "plain" land, and no attempt is made in this report to distinguish between them.

The yields of the wheat varieties has been generally good, and in many cases much above the general average of all fields. The same varieties show prominently in these districts, as in the Mallee and Wimmera, which may be taken as an indication of their powers of submitting to environment. The yield of the oat varieties is particularly encouraging, the familiar Algerian holding pride of place. It will be noted that on the farm of Mr. T. R. Sharp, at Goorambat, the Tasmanian Giant White produced 55½ bushels per acre, and the Stout White oat 52 bushels. These yields have raised the general average for the whole State.

CHARACTERISTICS OF THE WHEAT VARIETIES.

Farmers require to know something about the characteristics and habits of growth of wheat varieties, before deciding whether they would be suitable for their particular circumstances and local conditions. The following grouping of varieties will be found useful in affording the information necessary. The varieties are given according to the order in which they ripen:—

Variety.	Strength of Straw.	Stooling Quality.	Grain holding Quality.	Class of Head.	Period of Ripening.	Colom of Head.
Ranji	Fair	Poor	Good	Erect	Very early	White
Cumberland	Strong	Fair	"	Slightly drooping	"	"
Waddy	Fair	"	"	Erect	"	"
Outpost	Weak	Poor	"	"	"	"
King's Early	"	"	"	Slightly drooping	"	Bearded white
Terkin	"	"	"	"	Early	White
Smart's Pioneer	Strong	Fair	Inclined to shake	"	"	"
Gluyas	Fair	"	Good	Erect	"	Brown
Warrick	Strong	"	"	Slightly drooping	"	"
Improved Steinwedel	Fair	"	Shakes slightly	"	"	White
Steinwedel	"	"	Shakes badly	"	"	"
Nut Cut	Strong	"	"	"	"	"
Majestic	Fair	"	Good	"	Medium	"
Fan	Strong	Good	"	"	"	"
Steer's Early Purple	Fair	Poor	"	"	"	"
Newman's	Weak	"	"	Drooping	"	"
John Brown	"	Fair	"	Erect	"	Brown
Bobs	"	Poor	"	"	"	White
Frampton	Fair	Fair	"	"	"	"
Farmer's Friend	Strong	Good	Shakes slightly	Slightly drooping	"	"
Federation	"	"	Good	"	"	"
Schneider	"	"	Shakes badly	Erect	"	"
Hudson's Early Purple	Fair	"	Shakes slightly	Slightly drooping	"	"
Australian Talavera	"	"	Good	"	"	"
Sussex	Strong	"	"	Erect	"	"
Kubanka (Macaroni)	Weak	"	"	Drooping	"	Bearded yellow
Silver King	"	Fair	"	Slightly drooping	Late	White
Boomerang	"	Poor	"	"	"	"
Bearded Innomerata	"	"	"	"	"	Bearded white
Petatz Surprise	"	"	"	Erect	"	White
Marshall's No. 3	"	"	"	Slightly drooping	"	"
Leake's Rust Proof	"	"	"	Drooping	"	"
Tarragon	Poor	"	"	Erect	"	"
Dart's Imperial	Fair	"	"	"	"	"
Jade	Strong	Good	Inclined to shake	Slightly drooping	"	"
Manitoba	Poor	Fair	Good	Erect	"	"
Tardent's Blue	Strong	Good	"	Slightly drooping	"	"
White Tuscan	"	"	"	Erect	"	"

The above classification of the wheat varieties must not be taken as being absolutely binding. For example, there are degrees of earliness and lateness in ripening and what might be very early in one locality might be early or even medium in another.

The list merely indicates whether the varieties are early, medium, or late, without regard to districts. Further trials will show possible modifications in the dates of ripening.

Oat Varieties.

The inclusion of seven varieties of oats in the variety section of the Northern fields has produced some interesting returns, as follow:—

Bushels per Acre.

—	Algerian.	Tartarian.	Tasmanian Giant White.	Stout White.	Hopton.	Dun.	Black Norwegian.
Average of the Mallee and Mallee Fringe..	21·4	14·5	18·8	15·5	14·2	13·6	11·9
Average of the Wimmera	30·5	24·5	35·1	31·5	23·0	26·2	21·9
Average of the North and North-Eastern Plains	32·5	27·5	32·0	29·1	26·0	21·7	25·6
Average for the Whole State ...	27·4	21·3	27·4	24·0	20·1	19·6	19·1

The well-known Algerian oat, it will be remarked, has held its own well. The only varieties to compare with it in yield being the Tasmanian Giant White and Stout White Oats.

The Algerian is the earliest variety to ripen, the next being the Tasmanian Giant White, followed by the Black Norwegian, Dun, Hopton, Stout White, and Tartarian, in that order. Both the Tasmanian Giant White and the Stout White oats are coarse in the straw, and less suited for chaffing than the other varieties. The Dun oat is a very slow grower during the winter, and has a tendency to creep on the ground, which trait has not made it a favourite.

The Hopton and Black Norwegian oats are dark in colour, and have not the same attractive appearance as the more plump and whiter varieties.

General Summary.

What the farmer wants to know, in as few words as possible, is: What have the trials of the wheat and oat varieties taught him?

The answer may be briefly set out as follows:—

(*a*) That there are a number of varieties, which might with advantage be introduced in order to bring about a change of seed.

(*b*) That some of these varieties have special characteristics of straw, grain, or habit of growth which make them particularly suitable for conditions prevailing in certain localities.

(*c*) That some varieties by reason of their earliness or lateness of ripening, would not coincide with the harvest of other varieties, thus preventing prompt marketing of the grain, and causing a prolonged harvesting season.

(*d*) That some of the varieties grown possess better milling qualities and contain a better percentage of flour-making material than others, which should give them an added value in the eyes of the miller, and will probably lead to the payment of a better price per bushel, where such wheats are systematically grown.

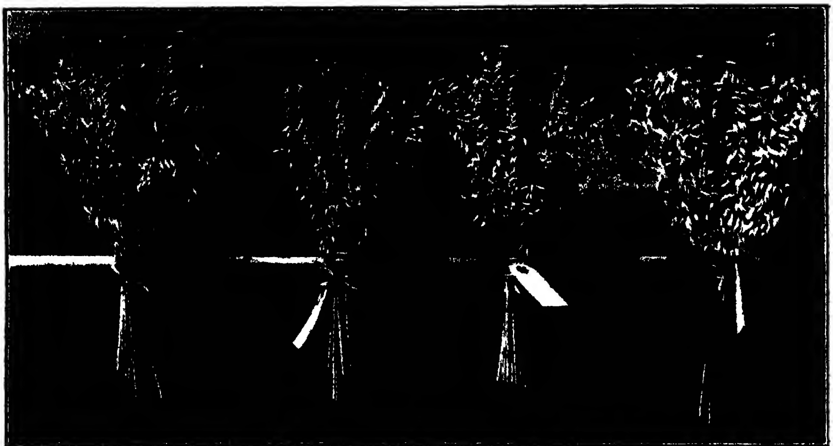
(*e*) That the bearded wheats are difficult to strip.

(*f*) That during the past season the very earliest wheats have been the poorest in yield. Further trial is necessary to confirm or disprove this point.

(*g*) That of the oat varieties tried, there are none which offer superior attractions to the Algerian as a hay crop.

(*h*) That for grain, the Tasmanian Giant White and the Stout White oats have much to recommend them.

When discussing the yields and characteristics of the wheat and oat varieties, the farmer must consider that the varieties themselves have not, perhaps, had the opportunity of showing to the best advantage during the past year. It is intended to sow only wheat varieties during the coming season, and special efforts will be made to enlarge the scope of the present investigations. The merits of a variety can only be fairly judged when at least two years' results are at hand.



Black Norwegian. Hopton. Stout White. Tasmanian Giant White.

POULTRY REMINDERS.

H. V. Hawkins, Poultry Expert and Lecturer.

Eggs that are not gathered daily at this time of the year (if fertile) go off immediately.

By keeping the male bird away, the eggs keep fresh twice the length of time.

This is the time to dispose of all old hens; it will not pay to keep them ten weeks during feather making only. Always bear in mind that the older the hen, the longer she will take to moult, and to commence to lay. I have known hens seven years old to lay 13 eggs in 12 months; that won't pay.

Make up your mind to keep a breed and determine to master that breed.

Farmers having incubators and brooder houses should now open them up to allow plenty of air and sunshine. This is a safety valve for next season's work of hatching.

Remember that an egg contains more than 70 per cent. of water, hence the necessity of clean water for your stock.

How can people allow their fowls to drink the filth in the back yards of our crowded suburbs? Yet it is a common occurrence.

Dairymen are called to account for this offence. Is it not time that the haphazard, dirty, poultry keeper should likewise be taught a lesson on cleanliness.

Poultry breeding must be worked on regular and careful lines if you aim at success.

Every day brings with it its little worries and great patience is required by every poultryman.

Show the birds kindness, and they will become quite tame and more manageable.

Keep the drinking water out of the sun. If this is neglected, cholera may cause you serious loss.

Vegetables form the most important part of the summer diet; use raw, and cut finely, or suspend about 2 feet from the ground. This will give exercise to those in small pens, and will keep down fat.

Note.—Eggs are not only used in the kitchen, but millions of dozens are used in the manufacture of goods, and each year we find a new industry launched for which tons of eggs are used. Think, for a moment, of the enormous increase in the illustrating of our journals—by the half-tone system—now in use throughout the world. Each illustration block requires the use of the hen's egg.

Separate the Sexes.

The male bird should now be kept by himself. He requires a varied diet whilst moulting the old feathers out.

You may assist him by pulling out the two top and the under sickles, as they are the most troublesome to him.

See that a fourth of his meal consists of raw vegetables, and a little fresh meat regularly. Add a teaspoon of raw linseed to the morning meal.

Feathers are formed from similar (nitrogenous) material to that which produces the hen's egg.

The more range the hens have after their year's work, the better will they moult, and the stronger will the early chicks be.

Profit with Two Hens.

During the year ending 31st December, 1905, two pullets that were hatched in August, 1904, commenced to lay on 30th March, and finished with an average egg return of 20 each month for nine months, or 360 eggs in all, which realized an average return of 1s. per dozen, or 30s. the lot.

The cost of feed amounted to 10s. 10d., which included pollard, bran, meat, pea-meal, barley, and vegetables. They were kept in a shed 19 ft. x 12 ft., with no grass, but ample supplies of green lucerne, thistles, raw onions, &c., chaffed fresh each day.

These two pullets were a first cross of Silver Wyandotte and Silver Dorking, the progeny of a magnificent laying strain.

DISEASES OF FARM ANIMALS.

S. S. Cameron, M.R.C.V.S.

II. GENERAL INDICATIONS OF DISEASE (*continued*).

TEMPERATURE.

Internal Temperature.—The standard of internal temperature of the various domestic animals has been carefully observed in both northern and southern hemispheres, and a consensus of records shows that under the same conditions of sun and shade temperature the internal temperature of animals in Australia does not vary from the European standard. During the prevalence of high sun temperature, however, such as sometimes persists for days or weeks on end in Australia, it may rise as much as a degree. Interesting evidence on this point, which supports the author's observations on animals, was obtained as regards man by Dr. Gresswell during successive voyages through the tropics.

The internal temperature of animals as of man is subject to slight increase towards the evening, but this is less likely to be due to the "heat of the day" than to its "burden," in that during the day the movements of the animal and its activity in foraging are productive of greater tissue change than occurs during the placid hours of the night. In horses at work the morning fall of temperature is not so constant, but a rise of temperature in the evening of from 1 degree to 1½ degrees F. over the morning record may always be relied upon in both horses and cattle at pasture. This is a point of great importance to bear in mind when temperatures are being taken at successive intervals for comparison. In the interpretation of the temperature record during the application of the tuberculin test to cattle it is necessary to take this evening rise into account when comparing morning and evening temperature, otherwise, when the tuberculin-injection has been done at early morning, the natural evening rise of perhaps a degree and a half might be mistakenly interpreted as a reaction and a consequent error in diagnosis made. It is always wiser to carry out the tuberculin-injection in the evening and to use the evening temperature as a standard from which to estimate a re-acting rise, in which case the cow is given the benefit of the fall towards morning which may naturally be expected.

In animals the temperature is usually taken by inserting a clinical thermometer into the rectum in males or vagina in females in such manner that the mercury bulb reaches 2 or 3 inches inside. When using the thermometer in the rectum care should be taken, by back-raking, if necessary, to have it empty, otherwise the bulb of the thermometer might be enveloped in a mass of fœces at a temperature considerably lower than that of the body. Various so-called veterinary thermometers have been at different times placed on the market with devices supposed to prevent breakage and to facilitate their use on restless animals; but, on the whole, the ordinary clinical thermometer used in human practice is to be preferred. The ordinary thermometer requires to remain in position some three minutes before the mercury will register the highest limit, but much time is saved if the quick registering, but slightly more expensive, "half-minute" thermometer is used. A new thermometer, if not purchased with a Kew certificate of correctness, should always before use be first tested with one known to register accurately.

I desire to here record my experience that after a thermometer has been used on, say, 40 or 50 animals in quick succession, it will be found to register a degree or more higher than another that has not been so continuously used, both thermometers having, prior to use, been tested, and found to register alike. After a period of non-use the high-registering thermometer will again register accurately. I was at first inclined to believe that the high registering under the circumstances resulted from the expansion of the glass, arguing that, as under the influence of heat it would expand in all directions, the lumen of the thermometer would be diminished in calibre, and the column of mercury would consequently rise higher; but Mr. Baracchi, the Victorian Government Astronomer, to whom the matter was submitted for elucidation, while not desirous of being finite on the point, is of opinion that the phenomenon is more likely due to some molecular change in the mercury, as a result of it being kept in a continuous state of agitation by the alternate heating and shaking to which it is subjected during use, and "knocking down" between times.

With the reservations that the temperature is usually higher—

(*a*) In the mornings than in the evenings.
(*b*) In young animals than in mature ones.
(*c*) In animals of "nervy" temperament than in sluggish animals
(*d*) In animals living in the open than in those stabled.
(*e*). In well-fed animals than in poorly-fed ones.
(*f*) After clipping (horses) and shearing (sheep).
(*g*) During digestion and after exercise or excitement.
(*h*) In the male than in the female, except when in season.

the normal standard of temperature in the different domestic animals is as follows:—

Horse, 100·0 to 101·0° F.
Cow, 101·5 to 102·5° F.
Sheep, 103·5 to 104·5° F. (as low as 101·0° after shearing).
Pig, 103·5 to 104·5° F. (very variable).
Dog, 100·0 to 103·0° F. (varies with external temperature).
Fowl, 105·0 to 108·0° F.

Increase of temperature to the extent of two, three, or more degrees above these averages is an indication of the existence of fever, and such increase is often the first ascertainable evidence of the onset of infective and contagious diseases, such as strangles in horses and pleuro-pneumonia in cattle. On the other hand, the temperature is not a reliable criterion in such slow-developing diseases as tuberculosis, in which it is apt at times to be very erratic. After the persistence of high temperature a gradual fall evidences a decline of the fever and a tendency to recovery, but a sudden marked fall in such cases is indicative of "collapse," and is often the precursor of death. A temperature below normal is observed in milk fever, and other diseases in which the brain is affected, and also in diseases of a debilitating or typhoidal type.

External Temperature.—The surface temperature of the body should be uniform to the touch at all parts. The ears, horns, feet, and shanks are slightly cooler than the rest of the body; but here, also, the degree of warmth should be uniform. In the early stages of inflammatory and febrile diseases, the extremities may be cold, or sometimes the ears may be hot and the legs cold, or *vice versâ.* Such conditions, as also coldness of the surface of the body either all over or in parts, and of the expired air, is indicative of faulty or ill-balanced blood circulation, and should suggest the administration of stimulants and the clothing or brisk grooming of the body. They may also be premonitory of that deathly coldness which

precedes a fatal termination. Hand-rubbing of the legs, and bandaging with either woollen bandages or straw ropes, together with pulling friction of the ears, sometimes have a wonderful effect in restoring equilibrium of circulation without the aid of medicinal stimulants.

SECRETIONS.

PERSPIRATION.— Excessive perspiration, when not due to palpable cause, such as unwonted exercise or excitement, usually accompanies increase of body temperature, and is an indication of fever. It involves an increased functional activity on the part of the sweat glands of the skin (sudoriferous glands) and assists in the abstraction of animal heat, not only because moisture is a good conductor of heat, but also by reason of the fact that heat is necessary for the evaporation or drying of perspiration, and it is consequently radiated or given off in greater amount after profuse sweating. The "cold sweats" to which horses are subject also occur in fever when there is a rush of blood to some internal organ, and they serve to prove that excessive perspiration does not necessarily depend upon an engorged condition of the blood vessels of the skin, but is rather brought about by glandular activity, the result of nerve stimulus. Sweating in patches is seen only in the horse and the "breaking out into a sweat," which may occur two or three times after being rubbed dry after work is also peculiar to horses. It is interesting to note that the horse is the only domestic animal, in fact, the only animal entirely covered with hair that sweats naturally over all the surface parts of the body. Cattle sweat through the muzzle; dogs and cats through the foot-pads, and from the tongue, and the pig from the skin of the snout only.

Nasal Discharges.—The abnormal discharges from the nostril are often of such a distinctive character as to be of use in diagnosis. In nasal gleet the discharge is thick and white, and sometimes curdled, while in glanders it is thin and sticky, of a pearly grey colour, and sinks in water. In either disease it may be fœtid or not, according to whether the ulceration from which it proceeds has extended to the bone or not. In influenza the discharge varies in successive stages of the disease. It may be catarrhal (watery), mucoid, muco-purulent (mucus and pus) and purulent. In anthrax the discharge from the nostrils may be black or yellow (citron-coloured). In pneumonia it is charged with changed blood pigments, and is rusty coloured. In catarrhal pneumonia it may be muco-purulent, and in croupous pneumonia amber-coloured and viscid. In suffocative bronchitis the discharge is frothy, bloody, and profuse. In bleeding from the nose, the bloody discharge varies according to the seat of the hemorrhage. If from the nostrils (epistaxis) it is clear, unmixed non frothy blood; if from the lungs (hoemoptysis) it is bright scarlet in colour, mixed with froth and mucus, and may be accompanied with a cough; and if from the stomach it is dark-coloured from the action of the acid of the gastric juice with which it is mixed.

Other Secretions.—The secretion of the various organs and tissues of the body are liable to be altered during the progress of disease. They may be—

(1) *Diminished.*— As in the early stages of a febrile disease, such as pleurisy, when the pleural surfaces become dry and give rise to the "friction sound" heard on auscultation.

(2) *Increased.*—The increase of one secretion which usually occurs when others are diminished is well seen in milk fever in cows, when along with suspension of the milk function there is a corresponding increase of urine secretion.

(3) *Perverted.*—When a secreting organ, such as the liver, is diseased the chemical composition of its special secretion is frequently altered. In some cases one set of organs takes on the function of another. For example, the kidneys commonly take on the function of expelling bile from the blood when, either from disease of the liver, or from obstruction of its ducts, the bile is not being got rid of in the orthodox way. Similarly, when the function of the kidneys is suspended a condition of uræmic poisoning is set up in the system, and this is frequently relieved by a compensating increase of activity of the skin glands, by means of which the urea and other waste matter circulating in the blood are got rid of through the perspiration.

EXCRETIONS (FŒCES AND URINE).

Fæces.—The condition of the bowels, as evidenced by their frequency of movement, and by the character of the dejecta (fœces) is a guide of such importance in the diagnosis of disease that inquiry and examination regarding it should never be neglected. The average daily movements of the bowels (defœcation) have already been given, and the normal characters of the dejecta have also previously been described (see page 20). Any variation in colour, smell, consistence and composition, and the presence of foreign bodies, worms, whole grain or undigested food-particles, should be noted and rational inferences drawn therefrom. Darkened colour and foul smell are often associated with *constipation* or bowel-sluggishness. Hardness and sliminess of the fœces point to catarrh of the large bowels, and suggest the administration of oleaginous laxatives. The presence of undigested grain or other foodstuffs should suggest an examination of the teeth and mouth. If present in large proportion, and accompanied by abdominal uneasiness, a "gorging" of the particular food that is undigested may be suspected, and steps should be taken to avert an attack of inflammation of the bowels or of laminitis.

Diarrhœa should not always be treated with astringent or binding medicine. It is frequently due to the presence of irritating bowel contents, the removal of which should be facilitated by the giving of gentle purgatives. Conversely, purgative medicines in constipation are at times harmful. In paralysis of the bowels there is constipation, accompanied oftentimes by abdominal rumblings, indicating the presence of gases and fluid. Such cases should be treated with tonics and nerve stimulants rather than with purgatives, which may increase the mischief.

The Urine is scanty and usually high-coloured in febrile conditions. The presence of an excess of sediment, except it is long-continued, is not necessarily a sign of disease. The urine may be tinged with blood in congestion or inflammation of the bladder, and if pain is evinced on passing it, some irritation of the urinary passages may be inferred. In redwater and azoturia the change of colour depends upon the presence of quantities of the dissolved colouring matter of the blood. In some forms of jaundice and other diseases of the liver, the kidneys take on the function of excreting from the blood more than their ordinary share of effete

material, and the urine is often heavily charged with bile or bile salts and colouring matter. Errors in diet often cause increased secretion of urine, perhaps the most familiar example being the feeding of musty hay. Potash salts or food which is rich in them, such as oats and grasses, always give rise to the elimination of an excess of soda salts in the urine, and consequently when such foods are habitually used the animal should always be allowed access to common salt *ad lib.*, or should have it mixed in the food, so that the waste of salt from the blood may be made good.

Fever.

Fever is an abnormal condition of the system characterized primarily by an undue elevation of temperature, but also by the proportionately increased frequency of the pulse and respiration, by diminution of the secretions—urine, saliva, sweat, milk, intestinal juices, mucus, bile, &c.—and by perversion of nerve force. In infectious diseases fever succeeds on the termination of the *period of incubation*, by which is meant the time which elapses between the contracting of infection and the first manifestation of symptoms, during which the disease is "brewing," so to speak.

In fever there is a disturbance of that equilibrium naturally existing between the production and loss of heat by which the normal balance of temperature is maintained. This disturbance consists in an increased production of heat, and consequent rise of temperature. Evidence of the tissue combustions, which accounts for the increased production of heat, is seen in the rapid emaciation and increased elimination of the products of oxidation of the tissues—urea, uric acid, carbonic acid gas, &c.—which usually accompany a condition of fever.

During fever certain symptoms are observed which will be referred to throughout as *febrile symptoms.* These may be grouped under three headings, according as they are associated with the three stages of fever—the attack, the crisis, and the decline. Those of the *first*, or "cold stage" are rigors or "chills" or shivering fits, crouching attitude, arching of the back, coldness of the skin and extremities, due to contraction of the arteries of the skin, and the internal determination of blood, which is also manifested by rise of internal temperature, pulse and respiration. In the *second*, or "hot stage" of fever, which lasts longer than the first, the last-mentioned three symptoms are maintained or increased, and are accompanied by dulness, loss of energy, and appetite (and rumination in cattle), and a hot dry skin—the reaction from the previous coldness. Later, the skin is bathed in perspiration; the legs and ears, and in cattle the horns, and dogs the nose, are excessively hot; the urine is scanty and high-coloured, and there is constipation, thirst, dryness of throat, mouth and tongue, cessation of milk secretion in lactating animals, and injection (redness) of the visible mucous membranes. These symptoms may be succeeded by more specific symptoms of some special disease, febrile symptoms being often premonitory to an attack of more serious disease of an infectious or inflammatory type. When the decline of fever commences—the so-called *third stage*—the above mentioned symptoms gradually abate, and the return to a normal state is expedited if the animal is rested in a well-ventilated box free from draughts, the body comfortably clothed, and the legs bandaged. The food should consist of mashes, gruels, and greenstuff, and saltpetre or chlorate of potash in half-ounce doses may be given in the mash or drinking water twice a day.

CLOSER SETTLEMENT STUDIES.

Australia Felix.

R. Crowe, Superintendent of Exports.

Christmas-time—cool stores full of produce—meat and rabbit exporters, butchers, and rabbit trappers all gone on holidays—arrangements made for discharging shipments on Christmas and following days; yielding to the contagion of the season, I catch the train on Saturday afternoon for Koroit to see relatives and friends, and revisit boyhood's scenes. Two trains left Spencer-street for the west crowded with passengers bent on a similar mission and holiday-makers leaving the city to recuperate in the country for a few days.

The journey came to an end soon after midnight, and Sunday morning showed the district fresh and green in every direction. The season's greetings tendered by everyone—old schoolmates and neighbours—made

A KOROIT OAT CROP.

one feel that life, after all, was well worth living. To me it was particularly so, and for the next three days driving, picnicking, and goodwill were the order of the day. As a lad, many a pleasant hour was spent on the beach at Armstrong's Bay, and now the same gathering of periwinkles and dozens of other kinds of shellfish, watching fishes of almost all sizes, shapes, and colours—bream, parrot, and zebra-coloured fish, some like little sharks—brought a complete forgetfulness of business cares for the time being. Perhaps few places can be found where the people are more industrious and thrifty or the land more fertile than in the district of Koroit. It is an accepted axiom that the capital value of land is determined by the amount—or rather the value of produce—it can be made to grow yearly, and when it is mentioned that the price of land in this district ranges between £40 and £70 per acre, some idea may be gained of the returns secured from it. In the borough of Koroit, the municipal valuation averages £50 per acre. and a strip of country from Dennington to Rosebrook, about 12 miles long, with a varying width averaging 2½ miles, and comprising about 30 square miles in area, is just as fertile, its continued fertility being chiefly due to splendid management. Each farmer notes closely not only the result of his own efforts, but also carefully observes the methods practised by the leading cultivators in the neighbourhood. Therefore, if a new variety of seed be successful, it is only a matter of a couple of seasons when it has spread throughout the entire district;

or, if any new development in tillage or the order of the rotation of crops takes place, or the use of improved implements or stock, the lesson is not lost.

Unless people are up early in the morning and watch every opportunity they cannot profitably hold such high-priced land. In this connexion it may be mentioned that some of the land which 20 years ago was deemed to have been exhausted has now been made by forethought and management to yield crops as good as are obtained from the best of it. By slipshod methods the soil became hungry, and poor crops of barley, hay, even potatoes and grass, were the rule. The potatoes were impoverished and blistery, and the cereals showed yellow and sickly, clumps of more vigorous growth here and there through the paddocks. The pursuit of a comprehensive scheme of rotation of crops, and the adoption of dairying and rational cultivation have brought the fertility of the farms up to a very high point; in fact, instances may be found where the problem of "how to prevent the undue growth of straw in the barley and oaten crops" is being seriously studied, for, when too heavy, the rain and wind spread the crops flat on the ground.

In order to convince readers in other districts of this State or elsewhere, I have obtained permission from certain farmers to mention their names; consequently, the systems of cultivation and their results may be seen by any one. Of course, in doing this, I owe an apology to hundreds of others who grow equally good crops and secure similar returns. I would recommend any one interested in the rotation of crops to pay a visit to the district at any time of the year, but preferably during the months of November or December, for a more suggestive object-lesson, as far as closer settlement and thorough farming are concerned, cannot be seen in any part of the Commonwealth.

GLENROSE FARM.

Mr. D. Mooney's Glenrose Farm, Illowa, of 155 acres, was the first I visited. Prior to last year it consisted of 112 acres, when 43 acres, costing £57 10s. per acre, or £2,472, were added; whilst about seven years before only 82 acres were occupied. The growth of this farm is specifically referred to, as it is typical of the district that all the most successful farmers began in a small way, and after having thoroughly mastered the management of their little properties added to them as opportunity occurred. In contrast to this method we find that many would-be farmers are ambitious to secure an area of 320 or 640 acres to commence with, and its cultivation, or "lack of cultivation," is responsible for the unprogressive condition of many neighbourhoods.

Glenrose Farm is subdivided into 13 paddocks, 72 acres under grass, and 12 acres of lucerne, making 84 acres chiefly devoted to dairying; and 30 acres of potatoes, 27 acres barley, 14 acres oaten hay, account for the remainder. The pasture consists of English rye-grass and white clover, but, on account of the green and vigorous growth of cow-grass knee-deep on a neighbour's farm, it is believed that an addition of cow-grass to the mixture would be an advantage. This cow-grass was sown with a mixture of rye-grass, but the former had evidently taken complete possession, and at the moment was showing in full bloom. Mr. Mooney states that the legumes are not "so hard on the ground" as rye-grass, as they cover the surface and prevent loss of moisture through evaporation. In ploughing, the rye-grass sod turns over dry, and has a skin requiring more cultivation

to make a good seed bed. When such is secured, it is powdery and hungry in appearance, unlike that after cow-grass and clovers. When turned up after the latter the soil remains more open, free and crumbly, and altogether in better heart and condition; it seems to hold the moisture better, and does not require the same amount of cultivation.

Sometimes a paddock of rye-grass is saved in the spring and cut for hay, and although lucerne does not do as well here as I have seen it in many other parts of the State, it is regarded as a great adjunct to the other pastures. The lucerne was cut twice this season, the second cutting being left on the ground. It is intended to graze it until next spring. The stack of 12 tons saved will be given to the cows before winter comes on. Mr. Mooney is well satisfied with lucerne, and intends sowing down another paddock. He also adds that "every dairy farmer should have lucerne." When grazed in winter it has a tendency to swell the cattle, but this is counteracted with the hay fed. No ill-effects have been noticed in the milk, and doubtless this is accounted for by the care taken in feeding. The cows are not at any time allowed the free run of the lucerne paddocks, being turned in for a couple of hours each day, when an increase in the milk supply always follows. Forty-eight dairy cows, 50 sheep, 8 two-year-old and 10 yearling heifers are kept. The sheep act as scavengers in clearing up the paddocks, and supply mutton. When all the flock are fat, they are sold and replaced with another lot of stores. The heifers are to replace old cows and culls, and a margin is provided, allowing for some not coming up to expectations. Five fat cows are being turned out for the butcher as the result of last year's experience with them in the milking yard. Some three working horses (mares), milk delivery-waggon horse, buggy horse, and pony for boys to run in cows, messages, &c., are kept.

GLENROSE DAIRY COWS.

The cows are all crossbreds (Ayrshire and Dairy Shorthorn), with the Ayrshire blood predominating. Calving occurs mostly in the months of May, June, and July, with other cows coming in at different periods, so that milking is carried on all the year round. At present a Durham bull is kept, and 43 cows are milked, a couple of months' spell being given each member of the herd before calving. Up till June last, only 25 cows were kept, but with the increase in the size of the farm, other cows were bought, and through the pressure of increased work and responsibility, together with the unreliability of outside labour, Mr. Mooney is making arrangements for the installation of milking machines before the opening of another season.

All the milk is delivered to the Southern Cross Creamery, a branch of the Koroit Butter Factory, and the following table shows the total quantity of milk delivered each month, the respective tests, butter contents, prices per lb., and cheques received, including a bonus:—

Month.		Gallons.	Test.	Butter. lbs.	Price.	Cheques.		
January	...	877	4·3	421	8½d.	£14	18	2
February	...	439	4·5	221	9d.	8	5	9
March	...	280	4·5	141	10d.	5	17	6
April	...	168	4·7	89	14d.	5	3	10
May	...	173	4·0	76	10½d.	3	6	6
June	...	926	4·0	411	10½d.	17	19	7
July	...	2,314	4·0	1,027	10d.	42	15	11
August	...	3,075	3·9	1,330	10d.	55	8	4
September	...	3,101	3·8	1,306	9½d.	51	13	10
October	...	3,623	3·8	1,525	10d.	63	10	10
November	...	3,425	4·0	1,519	9½d.	60	2	6
December	...	2,957	4·0	1,312	9½d.	51	18	8
				Bonus	...	3	5	9
		21,358						
Total		...	...	...	...	£385	7	2

Twenty-five cows was the extent of the herd for the first half of the year, and 48 for the latter half. The average return comes out in the neighbourhood of £10 per head; of course, as the larger number were milked for the flush portion of the season, the true average cannot be ascertained.

PIGS.

Some 60 pigs are kept, all reared on the farm from five brood sows. Berkshire sows and a white Yorkshire boar form the breeding stock. Until quite recently, Berkshires were practically the only pigs reared in the district, but continued in-breeding weakened their constitution, and now a first cross of the white Yorkshire, Berkshire, and Tamworths are in general demand, as their progeny are more robust, quicker growing, and better fattening pigs. The bacon curers like them very well. Two litters a year of from 8 to 12 are secured, with an average (after allowing for accidents and deaths) of not less than 8 at a time, or 16 pigs for each sow. When rearing the young, sows are given bran and lime-water in the food to keep up a good flow of milk, and make the young pigs healthy and vigorous. After providing for bran and other food, &c., the pigs bring in considerably over £100 per year.

POULTRY.

On asking about the poultry, Mr. Mooney at once went in search of Mrs. Mooney, as she has sole charge of that particular department. It was quite a treat to meet such an enthusiast. Although no account was kept of the eggs, I learnt that, in addition to a plentiful supply for the house, at least £1 worth per week is frequently sold, and Mrs. Mooney's average pocket money per week from this source would certainly not be less than 10s. Some 50 head of brown Leghorn fowls are on the place. Of course, nothing is purchased for them, grain seconds and potatoes being the only food prepared. No old fowls are kept, and a simple and ingenious

method is followed to determine the ages of each season's birds. A pig-ring is attached to the right ankle of the first year's chickens; the birds of the second year carry rings on the left ankle, whilst the third year's birds are left without any; then, as the next brood of chickens come in, the old birds with the right anklets are all fattened for the pot. The next year the left anklet poultry are treated likewise, and so on, the flock thus being kept in full profit.

Mrs. Mooney also directs the operations in the vegetable and fruit garden. Water is laid on from a windmill, and the year round all kinds of seasonable vegetables are abundantly provided.

POTATOES.

The 30 acres of potatoes are of the New Zealand "Pink-eve" variety, with the exception of one acre of "Brownell's Beauty." The latter turned out a failure, having missed, although they did fairly well, but not so good as the "Pink Eyes," during the previous year. The yield of the main crop just dug comes out at 6 tons to the acre.

GLENROSE BARLEY AND OATS.

Mr. Mooney grew 27 acres of Battledore barley, reputed to be grub-resisting, but he naively added: "In a bad year the caterpillars do not respect the reputation." He thrashed from the whole area 1,275 bushels, or 47 bushels to the acre; 13 acres of it averaging 55 bushels, the estimate for the whole Koroit district being from 45 to 50 bushels. The crop is said to be light on account of the severe weather experienced, but of course the absence of grubs this season is in the farmer's favour. A few years back, 68 bushels to the acre was the yield on this farm, and the poorest crop grown averaged 45 bushels. Formerly "Chevalier" barley was cultivated, but as it had to be cut too green on account of grubs, a good sample was impossible, and consequently it was abandoned. Barley is invariably grown after the potato crop, and is followed with oaten hay. About the 1st of June, the barley is sown, and the paddock is cleared again for the run of pigs and cows by the first week in January. Last season, the stock had possession before Christmas, and in a favorable year, after the pigs get the run of the paddock for picking up, a green growth of barley comes up providing splendid green stuff for the cows, and helping materially to tide over summer, autumn, and early winter.

Fourteen acres Algerian oats for hay are grown, yielding about $3\frac{1}{2}$ tons to the acre. Hay is spread in the paddock for the cows in the winter, as well as providing chaff for the horses. Last season it was chaffed and

fed to the cows in boxes, in addition to being given whole on the pasture, the paddock system affording the better results. The barley straw stacks also provide feed and shelter. In addition to the cows doing better outside, the pastures on which hay and straw are spread, benefited and showed much improvement as compared with the areas not touched. Particular emphasis was laid on the paying aspect of feeding hay to cows, Mr. Mooney warmly pointing out that "it keeps them strong in the winter, and they come in in better condition and fuller profit."

GLENROSE HAY CROP SAVED FOR COW FEED.

All the cows were rugged last winter with rugs home-made of two bags with beneficial results. Boxthorn hedges are grown for shelter, and four groups of 5 chains each, as well as blue gums are situated in favorable angles of the paddocks, those where the cows are chiefly kept at night being particularly sheltered with plantations. The blue gums were grown from seed set in boxes, and then planted out.

SUMMARY.

None of the crops or yields are exceptional, for the returns from the cows have been eclipsed in the State and elsewhere—both in and beyond the Western District. The estimate for the potato crop is not heavy, neither is there anything remarkable about the farm. The fact that intelligent and thoughtful cultivation has gradually enhanced the value of the property to an extent probably unequalled elsewhere is the most impressive point. Although it would be inquisitorial to supply definite returns, enough has been adduced to convince any one that with such management a loss would be impossible. In making up the results at the end of the year, the question resolves itself into one of relative profit depending on the season and prices. Although the capital sunk in the farm is large, there will be a considerable margin on the right side after interest on outlay, wages, wear and tear, and all expenses are provided for. While in a very bad season it may not amount to more than a couple of hundred pounds, in a good year it may run into over three times that sum.

The crux of the rotation system is its reliability—all the risks and uncertainties of the farmer being reduced to a minimum, yet authorities in the district readily admit that further observation will enable much more to be achieved.

Yangery Park Farm.

Across the road from "Glenrose," is the property of Mr. John Lindsay, Yangery Park, Illowa, which consists of 81 acres, with an additional 21 acres adjoining, making 102 acres altogether. He has also some 65 acres of bush land a few miles away where some of the young stock and dry cows are grazed. Sixty-seven acres are under grass, 60 being occupied by cattle, and 7 by horses. There are 13 acres of potatoes, 16 of barley, 3 of oaten hay, 1 of mangels, and 6 of garden, trees for shelter, pig paddocks, &c. A mixture of English rye grass, cow-grass, and white clover comprises the pasture. There are at present 55 cows on the property, 53 of which are milking, whilst up to 60, or a cow to the acre of grass have been kept on the place. Some 60 head of poultry, including a few ducks and turkeys, complete the live stock equipment, and keep the house going, bringing in about 10s. in cash per week.

YANGERY PARK HERD. "A COW TO THE ACRE.

SEASONABLE SUGGESTIONS.

A feature in connexion with Mr. Lindsay's management is that he not only feeds all the hay and straw to his stock, but also buys fodder from the neighbours. Last year he purchased 10 tons of oaten straw at 10s. per ton, and 5 tons of bran at £5, making a total of £30 for cow fodder. The straw is chaffed and fed with bran, and sometimes oats. Fifteen pounds' worth of wheat and £10 worth of pollard were purchased for pig feed. Mr. Lindsay is a firm believer in buying feed for cows and pigs, and in this respect he is following the practice of the most scientific countries in the world. Denmark, according to last year's figures which have just reached me, imported maize and oil-cake, &c., as fodder for cows to the value of £9,400,000, and exported to Great Britain £18,390,000 worth of manufactured food, almost wholly dairy products—butter, ham, bacon, pork, lard, &c. This is a lesson that ought not to be lost sight of by Victorian farmers. There is a desire to find a market abroad for hay, chaff, and other kinds of fodder. By all means dispose of produce in the most payable markets, but before going afield, the profitableness of feeding dairy cows as Mr. Lindsay does should be tried. In this case, it has been found economical to feed hay, straw, chaff, and bran to cows, grain and pollard to pigs, and thereby make more money than by selling the fodder outright.

METHOD OF FEEDING.

The cows are fed in the bails, and after milking is completed the feed is placed in a long trough for the following meal. A little salt is added and it is thoroughly mixed with boiling water. Bags are placed over the top, thus steaming the feed for some ten hours, and leaving it nice and warm when measured out. Feeding is commenced in February (mangels are given broadcast after turning out in the evening), and is continued till the end of March, by which time the rainy season usually begins, and has furnished a plentiful growth in the stubble and pastures. The object in feeding at this period of the year is to prevent the cows from running down in supply and condition, so that when the green grass is available they at once improve and come on in their flow of milk. If not fed thus early the milk supply dwindles almost to vanishing point. Many of the cows go out and the rest of the season is lost, whilst even of those which do not actually go dry it is rare to find that many come up again when the fodder is again available. The cows calve all the year round, but the chief number in July and August, just before the beginning of spring.

GENERAL FEATURES.

Clumps of hedges and trees provide shelter in winter, and in this respect Yangery Park is well provided, there being any amount of timber grown by a former owner of the property, and now wisely conserved; consequently it is not considered necessary to rug. The farm is divided into some eleven paddocks, and the rotation is typical of the system throughout the district, viz., potatoes, oats, barley, and four years' grass. It will be noted, however, that the barley is sown after the oat crop. Only two calves were reared this year, whilst last season twelve was the number. Thirty pigs including five Berkshire brood sows, are kept. One hundred fat pigs were sold during the last twelve months at over £2 per head. There is an average litter of about eight to each sow, with two litters for each season.

The following is a list of Mr. Lindsay's milk cheques for the last twelve months, with full particulars :—

Month.		Gallons	Test.	Butter. Lbs.	Price.	Cheques. £	s	d.
January	..	2,481	4.2	1,164	8½d.	4	13	9
February	...	1,480	4.4	729	9d.	27	6	9
March	..	1,317	4.6	687	10d.	28	7	6
April	..	793	4.5	400	14d.	23	6	8
May	...	1,244	4.3	599	10½d.	26	4	1
June	...	1,709	4.2	800	10½d.	35	0	0
July	..	1,946	4.1	887	10d.	36	19	2
August	..	2,149	3.9	1,050	10d.	44	0	6
September	.	2,924	3.9	1,264	9½d.	62	0	7
October	..	3,861	3.6	1,534	10d.	63	18	4
November	...	3,886	4.0	1,725	9½d.	68	5	7
December	...	3,600	4.2	1,687	9½d.	66	15	6
		27,693		Bonus	...	7	19	11
Total	...		...	...	...	£531	8	4

POTATOES.

Mr. Lindsay finds the New Zealand Pink Eye the best cropper by a couple of tons to the acre. The old red (*i.e.*, Brown's River) has not yielded well during late years. The unfavorable winds are deemed to be to some extent responsible. The stalks of the red potato are smaller, and get greatly tossed about, growth being thus retarded, whilst, as the New Zealand Pink Eyes spread closer to the ground, the leaves only are affected by the high winds. The unsaleable small potatoes are fed to cows and pigs.

FLOWERFIELD PIGS.

FLOWERFIELD FARM.

About a mile north from the Koroit Post-office is situated Mr. J. Martin's Flowerfield Farm, of 316 acres—241 are under grass, 39 potatoes, 22 oats, and 14 wheat. Twenty acres of the grass are reserved for meadow hay. Thirty cows are kept, and have brought in monthly cheques as follow:—

Milk (Gallons.)	Cheques. £ s. d.	Milk (Gallons.)	Cheques. £ s. d.
1,640	27 3 3	1,336	22 16 9
1,293	23 5 9	2,733	37 12 6
1,198	25 15 10	2,971	50 11 9
815	24 11 2		
806	18 12 9	17,201	57 17 5
600	13 11 3	Bonus	7 7 5
695	13 10 10		
908	16 16 8		£339 13 4

Mr. Martin's method of rotation is similar to those already described, but as a portion of the farm is on the edge of the good country and unsuitable for cultivation, it is devoted to grazing alone. A number of very fine Shropshire sheep are kept. Some 200 sheep and 110 lambs were fattened and sold to the butchers last year. £50 worth of wool was also disposed of, and the "Flowerfield" rams and ewes are regular prize winners at all the district shows.

CLOVERDALE FARM.

Adjoining Mr. Lindsay's property is Mr. W. Stacey's "Cloverdale" Farm, of 105 acres, 40 acres of which are under pasture, 30 potatoes, 20

barley, 11 oaten hay, 2 mangels, and 1½ maize, 1 acre being leased to a neighbour. The 30 cows kept yielded £280 for the year. Seventy pigs brought in £150, and deducting £20 for food, &c., £130 net. Different varieties of potatoes are grown, embracing 11 acres of "New Zealand Pink Eyes," 13 acres of "Brown's River," 5 acres of "Snowflake," and 2 acres of "Brownell's Beauty," but Mr. Stacey has made up his mind to drop the last-mentioned in future, as they have not come up to expectations. Threshing was just completed, and one paddock of Battledore barley yielded 63 bushels to the acre, the average for the whole crop coming out at 56 bushels.

FLOWERFIELD HERD. MILKING TIME.

In the barley-stubble is appearing burr, white and Japanese clovers. Mr. Stacey intends to feed pigs on the barley if it does not realize 5s. per bushel, and he is satisfied from past experience that it will pay him to do so. It may be mentioned that 14 head of young stock, 6 horses, and the pigs are grazed on the farm.

General Comments.

For the many now beginning to farm under the Closer Settlement scheme, it will be opportune to give further particulars of cultivation and of the seed sown per acre, &c., &c. The chief purpose of this rather rambling narrative is to indicate the methods practised by farmers in a locality famed for its high-priced land. So far, it will be seen that the profitable cultivation of the soil, the system of rotation, and the feeding of hay, grain, and straw to the stock are the points most commended. In addition to these, however, it should be mentioned that the implements, machinery, and horse-power have been studied closely with a view to increased efficiency and greater economy in working.

I can recollect as a lad when the Clydesdale horses were in general use. The heavy work in connexion with farming, viz., the carting of produce by road to Warrnambool or Port Fairy, favoured this breed. Carting operations began in January and continued daily right through to the end of April—the commencement of the ploughing season. Sellar's single-furrow ploughs were used for putting in potatoes, each row requiring three sods of 9½ inches. An acre per day was considered good, and it required a smart team long hours and constant work to sow 1¼ acre in a day. Very heavy double-furrow ploughs were also the rule, and so with all farm appliances and operations—they were heavy, slow, and cumbersome.

Now the Clydesdales are being supplanted by the Suffolk Punch, and a cross of these breeds, the animals being powerful as well as more active and possessing greater stamina.

In sowing potatoes, a plough of half the weight of the old-fashioned implement, of much lighter draught and turning a 14-inch sod, is used, so the two furrows cover each row of potatoes instead of three as before.

POTATO DIGGING AT MR. W. CROWE'S.

POTATO MEMORANDA.

Potato land is usually ploughed twice, and the early seed planted to a depth of 4½ inches. The crops are generally dug before the stalks have withered, or any hot weather experienced to injure the tubers. With the later crop, however, an extra inch in depth, or 5½ inches, is made for the seed in order that a good covering against the hot February sun may be secured. Rows are sown 28 inches wide, and sets planted from 18 to 20 inches apart.

The crop is usually drill-harrowed three times; on each occasion the implement is fitted with different tines. When the plants appear above the ground a drill-harrow is used, then hand hoed between. The second drill-harrowing, as well as repeating the former operation, puts a little earth up to the stalks, and the last harrowing is done as the rows are about to close. With hoeing, weeding, and hilling-up, cultivation operations are completed, and a clean, healthy and attractive-looking crop is the result. Probably not more than a few solitary stalks of "fat hen" (*Chenopodium album*). or docks, show to the acre when digging time arrives. Sometimes, however, rain falls after hilling-up and before the ground is covered with the stalks, when a luxuriant crop of "fat hen" is the result. In heavy ground a two-horse scarifier is used to burst up the soil, instead of the drill-harrow for the second cultivation, the practice being varied according to the condition of the land and its requirements.

HEAVY CEREAL GROWTHS.

As further evidence of the weight of cereal crops grown, it may be mentioned that the twine taken to bind an 11-acre paddock of oats was 19½ balls of 4½ lbs. weight each, or a total of 88 lbs. at 7½d., which comes to exactly 5s. per acre. A 25-acre crop of barley required 48 balls, or a sum of 5s. 3·5d. per acre for twine. Both these crops were grown where for 50 years the land has been cropping and grazing alternately without artificial manure.

KOROIT SEED FORMULAE.

Potatoes.—From one-third to half a ton per acre, depending on sample.

Barley.—55 lbs., or one and one-tenth of a bushel to the acre.

Oats.—80 lbs., or 2 bushels to the acre.

Pasture—A mixture of 15 lbs. English grass, ½ lb. white clover, and ½ lb. cow-grass per acre.

MILKING TIME AT GLENROSE FARM.

PROPORTION OF CROPS TO PASTURE.

The following details secured of five separate farms show the proportion of the different crops grown in the district to pasture :—

Total Acres	Grass	Potatoes	Barley	Oats	Hay.	Mangels, Maize, &c.
280	164	46	25	33	12	...
155	84	30	27	...	14	...
106	67	13	16	...	3	7
105	40	30	20	...	12	4½
100	40	22	17	20	...	...
746	395	141	105	53	41	11½

It will be seen that on an average 51 acres out of every hundred are under grass, 20 acres under potatoes, 14 sown with barley, 7 with oats. 6 with hay, and 2 of mangels. maize, &c.

BURNLEY SCHOOL OF HORTICULTURE.

FIRST PRIZE ESSAY, DECEMBER, 1905.

Subject: "The Most Common Causes of Irregular Bearing and Imperfect Development of Tree Fruits and their Remedies."

In the world of to-day a progressive evolution is taking place, where only the most capable are allowed to stand, and the slow and uninitiated are left behind. As with other things, the science of fruit-growing is rapidly forging ahead, and only the best and the most payable methods are in use. The time has been when many, failing utterly to comprehend that any knowledge was required, attempted to grow fruit without understanding anything about fruit trees, or about soils, or climate, or disease. The result was utter failure, and so the idea spread that fruit-growing was not a paying concern. Fortunately there were others, who had knowledge, and so were able to get good returns from their orchards. But to-day knowledge is more thorough and more prevalent. Fruit-growing has become a science worthy of being thoroughly studied, and people have begun to realize that it is no use trying to grow fruit without an adequate knowledge. Following on added knowledge came added economy, and so trees that do not give back a proper return for their size and age, must either be thrown out or treated so that this defect may be remedied as far as possible. This brings us to the subject of this essay, "The Most Common Causes of Irregular Bearing, &c."

Healthy Trees Fruit Regularly.

When a tree reaches the fruiting stage it ought to bear, and go on bearing systematically, till the weakness of old age is reached, when its paying life is done. But if the tree instead bears sometimes heavy crops, and sometimes none at all, or if it only fruits well on one side and grows very inferior fruit on the other, this is just the kind of tree that we cannot afford to give room to in a well-planned orchard. Some time ago the only thing to be done was to pull it up and throw it on the rubbish heap, and plant a new one, for often the cause of this irregular fruiting was unknown. But now the most common causes are known, and it only remains to apply the right remedies. We can now list the most important of these causes, and point out the remedies for each case.

Systematic Pruning a Necessity.

The most common cause of all is want of pruning, or want of sufficient and correct pruning. It is not at all uncommon to meet people who tell you that their fruit tree bears very heavy crops, and they boast perhaps that they took so many cases of fruit from it that year. When you ask them about the next year, they tell you that they do not expect much fruit then, but the year after that again there will be another good crop. That may do for the amateur, but it will not do for the professional fruit-grower, who must have a regular supply of fruit each year. The effect on the tree will be most hurtful. It will tend to curtail the life of the tree, and cause such exhaustion that it has to "lie fallow" for a season, because it has not the strength to put forth new healthy wood to bear flowers and fruit for the following year. These heavy crops, too, are very apt to break the branches and throw the tree out of form. Proper pruning will prevent this by allowing the tree to bear just sufficient for its strength, so that when next year comes the tree will not

have become so exhausted as to be unable to bear at all, or, at the most, only inferior fruit. The whole object of pruning is to insure more regular crops over a longer period, besides obtaining an increase in size of the fruit, combined with a better appearance and quality.

Types of Bearing Wood.

Each kind of fruit tree has its own type of bearing wood; thus the apple and pear on fruiting shoots and spurs, the cherry chiefly on spurs, the apricot and plum on shoots and artificial spurs, and the peach on one-year-old shoots and spurs. If the different types of bearing wood are not known, the pruner may cut away the very pieces of wood most suitable to fruiting, and no crop, or very little, will be the result. Especially may mistakes in pruning be made in trees that have peculiar habits of bearing. In the Jonathan apple the flower bud is borne at the end of the shoot or spur; the Irish peach, too, puts out long shoots on which the flower buds will be at the end. It will thus be easily seen that if the pruner cuts away half the shoot or spur, as would be correct in most trees to strengthen it, he will also cut away the fruit. If these shoots are left long the first year, and then bear fruit, the weight of it will bend the shoot and cause spurs to form naturally where the constriction of sap is. These spurs will then bear the fruit for next season, and the shoot can then be shortened. Williams' Bon Chrètien pear has the same manner of bearing, and so is treated in the same way. The Winter Nelis pear has always been considered hard to get to fruit, because its habit of bearing was not known. Only one kind of wood bears fruit in this case, and that is a small spur.

Other fruit trees are what is called "shy-bearing." By that is meant that the tree takes a longer time to mature its wood and bear fruit than other trees. It may bear a little fruit now and then, but will not bear full crops regularly. The Nickajack apple is one of these shy-bearing trees. A seedling fruit tree that has not been "worked," that is, neither grafted nor budded, is also irregular in coming into bearing. It is irregular, too, in the kind of fruit it bears, the latter not always coming true. Ten years will, in some cases, elapse before any fruit is borne, because the tree is too strong. The seedling is the strongest tree. "Working" is always a weakening factor, the sap not having so straight a flow.

Varying Degrees of Vigour affect Fruit Bearing.

Want of design or balance in the tree at the start is a frequent fault, and one that must place the tree at a disadvantage. Where one side becomes the strongest, it will continue to be the strongest at the expense of the weaker side, unless some means are adopted to restore the balance. In a young tree with its three main branches starting from the three uppermost buds, the top branch will always be found to be the strongest, the second the next strongest, and the lowest the weakest, because sap flows first and strongest to the highest point. This may be checked by leaving the weakest branch the longest, and the strongest the shortest. If this balancing has been neglected, or has not been sufficient, it may be done later still when the leaves are out. If the strongest be just topped, it will give the weakest time to make up to it.

Trees can often be seen with two or three strong branches on one side, and four or five weak ones to balance the other side. The weak tree will bear most on the shady side, for that will be the stronger side; while

the strong tree will bear its fruit on the sunny and exposed side, that having the weaker and riper wood. The fruiting wood should be evenly distributed throughout the whole tree, for equal size and vigour mean equal growth and fruiting. A well-designed tree will have a healthier life, will fruit more regularly, and live longer than one lacking balance. When a tree is getting old, its fruit will naturally become poorer; but if it be cut back and reduced in size, it will have less to do, and the fruit will be better and more sure.

When a Tree should Bear.

The ages and conditions under which trees bear have great influence on their regular bearing capacities. The maturity of the tree, not so much its age, decides the time of its bearing. In a very suitable position the tree might be allowed to bear in three years; whereas the same kind of tree, in an unfavourable position, might not be mature for ten years. Pears under favourable conditions may be fruited on an average of three years, and remain regular in bearing. In poor soils they would need five years. Apples, plums, and cherries can be dealt with in the same way. With peaches, a strong tree must be secured before allowing it to fruit; perhaps three years would be long enough in the hot north, where it is at home; but in the south and colder districts, not before it is five years old. The age is the same for apricots. Lemons differ, for wherever they grow freely they may be allowed to fruit.

The Need of Light.

"Blindness" is frequently the result of bad pruning, or insufficient thinning out. The sap runs to the highest and strongest point first, so that the heaviest shoots are found naturally at the top of the tree. These, if they are not taken away, form a kind of hood, preventing air and light entering the centre, to the detriment of the inside branches. It is quite common to find unripe wood inside, and consequent fruitlessness or blindness. Each branch should have sufficient room to throw out its fruiting shoots and spurs without cramping the next. The main branches should be at least 2 feet apart, if there are fruiting shoots. Where there are only fruiting spurs they could be closer. If the shoots at the top of the branches are not removed, the consequence will be that all the sap sent up by the roots will remain there, and the lower part of the tree, being unnourished, will become quite bare, and will be so much space wasted. By thinning out of too crowded wood, and by keeping the top of the tree light, the growth will be forced down below and the whole tree furnished with fruiting wood. "Blindness" may also be caused by the tree being either too strong or too weak. A strong tree may easily be made stronger by a wrong way of pruning. The bigger the wound the stronger will be the new growth. No heavy cutting back should be done on a strong tree, but the whole piece taken away. The fruiting wood will have to be some "removes" away from the trunk to get weak enough wood, as fruit is borne on a slow flow of ripened sap, and cannot be borne where the flow is strong. The branches should be encouraged to grow in a horizontal position, for sap flows strongest along the most upright channels. In a strong tree the sap is often so unripe that only leaf buds are formed, or such flower buds as are formed are pushed off. A weak tree will need a heavy pruning to strengthen it. Everything should be done in the way of cultivation, good drainage, &c., and the branches should be grown on as upright lines as possible.

Root Systems.

Trees, by wrong methods being adopted may be very much weakened, and, strange as it seems, it is perhaps then that a heavier crop of fruit will be borne. But this is only a temporary spurt of the tree, as it will be followed by irregular and light crops, and final death, if the tree be not in some way strengthened. A mistake when the young tree is first planted may cause irregular bearing. Very few realize the importance of pruning a young tree's roots. Often the young tree has strong roots on one side, and weak ones on the other. If the strong roots are not curtailed, the tree will be thrown out of balance, for it is an axiom in fruit tree culture that the side which has the strongest roots will also have the strongest branches, and these would throw the whole framework of the tree out of balance. Another way to balance the roots would be to plant the side of the tree with the stronger roots to the windy quarter; the opposition of the wind and the exposure would be a weakening influence. The cutting back of roots in the dormant season would weaken the whole tree, because it would mean that the reserve of food to be laid up by the roots would be lessened; also the cutting back of head and roots in the growing season will inevitably weaken. If the soil in the summer is allowed to get hard and impervious to rain, or is cultivated deeply, the whole tree is affected adversely. Any ploughing in summer should be very light, just enough to form an earth mulch and to allow rain into the soil. Cold, wet, heat, and drought, when excessive, will chill, sour, dry, and harden the roots, and so injure the tree. Where coarse weeds are turned in round the roots of the tree in winter, and cold and wet come, the result will be dangerous, as they would serve as a host for the water and sour the ground; if left on the surface they would prevent the sun from warming the soil. In summer both of these things may be done, and would be advantageous. The effects of heat and drought may be made less hurtful if proper treatment be given to the soil. The heat may be prevented drying up the roots by a mulch of light litter being put round the tree, or a soil mulch given. The severity of drought may be lessened by the soil round the tree being "dished," so that when rain comes every drop of water will be caught by the tree, and the soil mulch will also be of value.

The Importance of Sound Leaves.

Leaves have a great influence on the flower-buds, and, according to their size and vigour, will be the quality of the bud. They serve as the feeders of the buds, pumping up sap from the roots and elaborating it. So wherever any damage has been done to the leaves, the flower-buds, and consequently the fruit, suffer. If a severe frost has come when the leaves are on the tree, and nipped them, the fruit may be spoilt for that season. Hot winds, severe storms, and hail may also damage the tree, and cause destruction to the season's crop. An injury to the bark also necessarily weakens that part of the tree which is affected. The wounded part should be cleaned, the ragged pieces cut away, and clay put over the wound to prevent air entering, so that the damage sustained may be repaired.

The nature of the seasons has marked effects upon trees. The weak tree in a favorable season might be strong enough to bear, but if a severe drought comes, it is too weak to bear. A strong tree in a good season would be too strong to bear, but a bad season might have just the weakening effect the tree required, and so a good crop would be the result.

Good Drainage aids Bearing.

The uneven bearing of a tree is sometimes caused through bad drainage. On one side of the tree the water may lie at its roots, and on the other there may be insufficiency of water. The first position may suit a water-loving plant like the quince or the fig, but the dryness of the other side will perhaps kill that part of the tree, or curl and shrivel up its fruit. Orchard land must be drained. Clayey soils need draining more than sandy, for the latter are often naturally drained. Draining will prevent surplus water lying about in winter, and will conserve water for summer use. The more uneven the depth and the surface of the soil is, the worse will be the natural drainage; and the worse the drainage is, the more uneven will the fruit-bearing be. So any cost incurred by draining will be amply repaid by full crops.

What Cultivation Secures.

Improper cultivation plays its part, too, in the irregularity of fruit cropping. The three principal foods that trees need are nitrogen, potash, and phosphoric acid; and lime may be added to these. These all have their functions to perform that the tree may be nourished and bear fruit. The nitrogen gives the deep green to the leaves and strong young growth, the phosphoric acid is required for the ripening of the wood, while the potash is necessary in the fruiting stage for the ripening of the fruit. Lime is a quickener of all three and other plant-food salts, and so is always an adjunct to a soil. Trees for a while may grow and bear well on what there is already in the soil, but there must come a time when, if nothing be given back to the orchard to replace that used up, nothing will also be returned from the trees. The trees can tell us themselves what they are needing. If they are making rapid growth, and have deep green foliage, and mature their wood well, it shows they are well supplied with food. But if they grow slowly the second or third year after planting, and their foliage turns yellow, it shows they have need of food or moisture, or both. If trees make too rapid a growth on reaching bearing age, and show little inclination to fruit, it means they are getting too much nitrogen, so the planting and turning in of leguminous crops, which have the power of collecting and storing up nitrogen, must be discontinued. Potash must be restored continuously to the soil, as the tree removes more of this component than of the others. It can be given as a manure in the form of kainit. Phosphoric acid can be given as bone-dust, guano, and superphosphates, and nitrogen by the turning in of leguminous crops, such as vetches, peas, beans, lupins, clovers, &c. The whole of the orchard cannot be treated with manure salts; that would be too costly a business, but individual areas might be treated. Cultivation also means the loosening and pulverizing of the soil, which is done in orchards by the plough, the disc, and the harrow. The two chief seasons for this work are autumn and spring; it is also done at other times, according to the need and the weather. If cultivation be neglected the trees will suffer to a considerable degree. Cultivation means the mixing and reblending of the soil grains, the exposure of fresh surfaces, and the opening of the top soil to allow air and water in. It can therefore be understood that cultivation is very necessary to the well-being of trees.

The Tree's Inner Nature.

We have dealt so far with the tree as a whole, and the conditions affecting its health as a whole, but now we can approach the tree closer

and examine its buds and flowers, and see if any cause can be found for irregular bearing. The first cause will be found in the dropping of buds. Buds may form all over the tree, and a good crop is expected. A great many of these drop off, leaving only a miserable crop to mature and ripen. When this dropping occurs on long shoots, the reason very likely is that there is not sufficient sap to support them all. The pruning is at fault, and this can be remedied by reducing the shoot and making it strong enough to bear what buds are left. Another reason for bud dropping may be that the flow of sap is too strong in a shoot near by where a heavy cut has been made by the pruner. Do not prune the strong shoot hard, or it will grow stronger, but thin out and expose it, so that it may ripen well and bear. An improper ripening season of the previous autumn will cause bud dropping; this may have been caused by a very mild summer or imperfect drainage about the tree, or the tree may have been too crowded. A great many flowers always fall, especially with apples and pears, a fortnight after the trees have come into flower, but this is Nature's own pruning or thinning, and one to be desired. An early frost often plays havoc with buds, nipping them off when they are swelling to form flower buds. In stone fruits the flower buds are more subject to harm from cold than leaf buds. The weather of the season before the expansion of the flower buds exerts a potent influence upon the number of flowers formed; the weather also during the expansion of the flowers and the setting of the fruits increases or reduces the coming crop.

The imperfect setting of the fruit is another cause of irregular crops. This is greatly influenced by the prevailing weather, so that one year the crop might be much heavier than that of another year. If a severe late frost comes when the fruit is just formed, it will be responsible for the dropping of the young fruit; and if cold, hail, and rain are prevalent about this time, the fruit will get knocked down or damaged. Bad weather, especially cloudy weather, if it lasts for some time, is very injurious to the fertilizing of the flowers. Fruit trees are almost altogether insect fertilized (to a small extent, perhaps, they are wind fertilized), and in bad weather bees will not be out working. So the longer cloudy weather lasts the fewer will be the flowers fertilized, and consequently the less the fruit borne. Very windy weather blows the pollen away, and causes flowers to be infertile. A great many of the tree fruits are infertile to their own pollen. For this reason an orchard planted solely with Bon Chrètien pears will be found to be unfruitful, simply because of the infertility of their own pollen, *i.e.*, their flowers will not set unless their stigmas receive pollen from some other variety. So it is necessary that at least three or four different varieties should be planted in every orchard. It is wise to plant together those varieties that flower about the same time.

Destructive Agents.

Another cause of imperfect setting is the presence of disease in the tree. Disease is always weakening to a tree, and it is those trees that are the weakest that disease most rapidly attacks. So to avoid disease the tree must be kept healthy. Especially are leaf-eating insects to be kept away from trees. The leaves are the feeders of the flower buds, and if they are eaten away and destroyed, the buds will also perish. The peach aphis is very serious for this reason. It prevents both flower and leaf buds from opening well, and distorts the young shoots. When severe it will cause the leaves to fall at a time—October—when the tree has need

of all its leaves. Where it is present the trees should be sprayed with Bordeaux mixture (6 lbs. bluestone, 4 lbs. lime to 50 gallons of water) in winter, or with tobacco water (1 lb. each of tobacco and soft soap to 20 gallons of water) when it appears in the spring. Fumigation, when the tree is in leaf, with cyanide of potassium is good, but is expensive. To strengthen the tree so that it may throw off the disease, mulch the ground with tobacco refuse or manure salts, especially kainit or rock salt.

The pear slug damages the leaves of the pear, cherry, and plum, eating away the tissues and leaving only skeleton leaves, and so ruins the fruit. As the slug has a slimy coat, ashes, or fine earth, or lime thrown on to it will cause it to curl up and fall to the ground, where it will die. A spray of Paris green (1 lb. Paris green, 5 lbs. lime to 300 gallons of water) can be used where the pest is bad. For the larva in the soil, a solution of bluestone or sulphate of iron might be put into the ground.

Some of the fungous diseases, too, are dangerous to the buds. Peach leaf curl is one of the worst. It attacks the leaves as they unfold, blistering them and preventing them fulfilling their proper function of starting the buds in the spring. To remedy this disease, spray with Bordeaux mixture in winter after the pruning. In spring, as the leaf buds are bursting, spray again with one-third the strength. Never allow old prunings or infected leaves to lie about to spread the disease. Some varieties suffer more than others, so do not plant them. Briggs' Red May, Crawford, and Salway are, in most soils, good resistant varieties.

Black spot of the apple and pear causes cracking and distortion of the fruit if it comes early, and scurvy patches if later; very often the fruit falls off. Spray for this disease with Bordeaux mixture in spring, when the flower buds open. Some varieties of apples, Cleopatra, Ribston, and Fillbasket, are very susceptible to it, and should not therefore be grown where the disease is bad.

Powdery mildew of the apple distorts the leaves, and so also affects the buds. To prevent it spreading, burn all prunings and spray with Bordeaux mixture in early spring, and in winter stronger.

The pear phytoptus or mite damages the leaves by blistering them, and thereby causes the tree to shed its leaves prematurely, to the detriment of the fruit. Spray with kerosene emulsion (½ lb. hard soap, 1 gallon of water, 12 gallons of kerosene) or soft soap and sulphur (1 lb. to 5 gallons of water) in summer.

Oidium or powdery mildew of the vine prevents the leaves unfolding properly. Dust with ground sulphur in the early morning while the leaves are moist.

Black spot or anthracnose of the grape attacks the fruit itself, causing a malformation in the fruit. Vines should be stripped of the loose bark and painted with Bordeaux paint (Bordeaux mixture, with clay and lime mixed with it).

It can be seen from all these facts that a great deal depends on the start in life a young tree gets, whether it is at home in its surroundings, and also whether it is built up properly and receives proper treatment all its life. These points decide the difference between a regular and an irregular tree, a paying and a non-paying one.

—E. M. ROLLAND.

SURVEYING ON THE FARM.

A. S. Kenyon, C.E.

Mensuration.

Both the horizontal and vertical method of taking measurements, so far as applicable to the ordinary wants of the farmer, have now been gone into. Some of those given have their direct application, while others are of indirect use only. Their use involves what is known as Mensuration; that is, the finding of areas and volumes or quantities. The area of any figure or surface is the space contained between its length and breadth without any regard to its thickness. In the case of rectangular figures, that is with four right angles, the length and breadth are easily obtained.

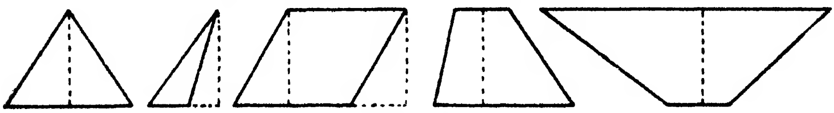


Fig. 23.

In triangles, the area is the base or breadth multiplied by half the perpendicular height, that is, the line drawn from the opposite angle at right angles to the base. If the triangle has one angle a right angle, the area then is half the result of the multiplication of the two sides forming the right angle. The area of a parallelogram, a four-sided figure with its opposite sides parallel, is the base multiplied by the perpendicular height, or, to put it another way, one side multiplied by its right angled distance from the other side—see Fig. 23. The area of a trapezoid, a four-sided figure with two sides only parallel, is the two parallel sides added together and multiplied by one-half their distance apart measured at right angles.

MEASUREMENT OF AREAS.

The definitions and rules just given may seem rather confusing; but their practical application is simple. Any paddock, no matter how irre-

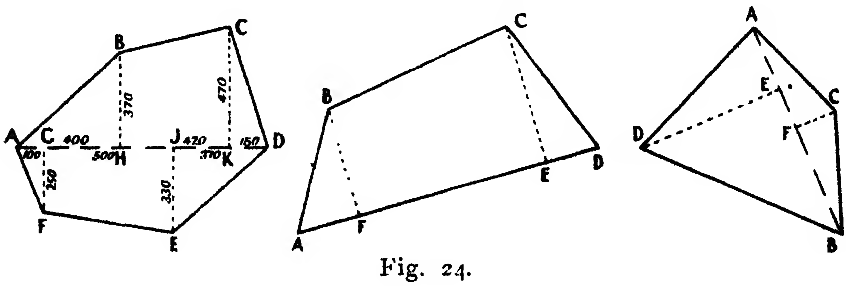


Fig. 24.

gular, so long as its sides are straight, may be divided into trapezoids and triangles, the triangles being generally right-angled. In such an instance as given in Fig. 24, a line is chained from the angle at A to the opposite angle at D. Along the line perpendiculars are laid out and measured, to

all the remaining angles, B, C, E, F. Then it will be seen that the area of the whole paddock is cut up into four triangles and two trapezoids. Their areas are—Triangle ABH equals the length from A to H multiplied by one-half the distance from H to B; the trapezoid HBCK is given by the length BH added to CK and multiplied by one-half of the distance from H to K, which is the perpendicular distance between the two parallel sides, BH, CK; the triangle KCD similarly equals KD multiplied by one-half KC. In like manner the areas of the two triangles and the trapezoid below the line AD may be found. The addition of all these areas will give the total area sought for

Taking the measurements given in the figure, the areas are—

Triangle ABH, 400 multiplied by one-half of 370 equals ...	74,000
Trapezoid HBCK, 370 added to 470, multiplied by one-half of 420 equals	176,400
Triangle KCD, 150 multiplied by one-half of 470 equals ...	35,250
Triangle AGF, 100 multiplied by one-half of 250 equals ...	12,500
Trapezoid GFEJ, 250 added to 330, multiplied by one-half 500 equals	145,000
Triangle JDE, 370 multiplied by one half of 330 equals ...	61.050
Total	504,200

The measurements are in links and the area sought is consequently 5.04 acres, or 5 acres 0 roods 7 perches.

In four-sided paddocks, which are not parallelograms or trapezoids, perpendiculars may be set up from one side only, two triangles and a trapezoid resulting, though in general, the measurement across the diagonal giving two triangles only is preferable—Fig. 24. The areas of the two triangles may be found by setting up perpendiculars as just explained. Should, however, the perpendiculars be difficult to measure, the following rule may be employed to find the areas of the triangles. In this case, measurements of the sides are required as well as the length of the diagonal. To find the area of a triangle when the lengths of all three sides are known, add the whole three lengths together and divide the sum by two. Call this result the half-sum; subtract from the half-sum each side in turn. Then multiply together the half-sum and each of the three remainders. The square root of the result will be the area of the triangle. Expressed in symbols, calling the sides a, b, and c, and the half-sum, that is, $a + b + c$ divided by two, S, the rule is—

$$\text{Area of triangle} = \sqrt{S \times (S-a) \times (S-b) \times (S-c)}.$$

This method involves measurement of the sides of the figure, and consequently is on the whole rather more cumbersome than the perpendicular method. All the examples given suppose it possible to get free access to any part of the inside of the paddock, but if only the outside is readily accessible, the method is still simple. Chain along one side; continue chaining, if necessary, until opposite perpendicularly the outermost angle. Extend the perpendicular through that angle, measuring offsets to the intervening angles, and chain along until another perpendicular can be set up to the next outermost angle. Chaining along thus, setting up perpendiculars to each angle the result will be a rectangle, of which the area is, of course, readily found, enclosing the area sought for. The triangles

and trapezoids outside the paddock, but inside the rectangle, are now to be calculated and their total subtracted from the area of the rectangle. The result will be the area of the paddock. Fig. 25 will show plainly the method.

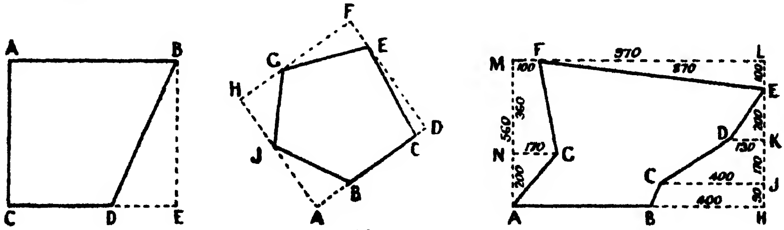


Fig. 25.

Using the measurements given in the figure, the area of the rectangle is 490 multiplied by 280, equals 543,200. From this has to be subtracted the outside triangles and trapezoids—

Trapezoid BHJC, 440 added to 400, multiplied by one-half of 90, equals	37,800
Trapezoid CJKD, 400 added to 130, multiplied by one-half of 170 equals	45,050
Triangle DKE, 200, multiplied by one-half of 130, equals ...	13,000
Triangle ELF, 100, multiplied by one-half of 870, equals ...	43,500
Trapezoid FMNG, 100 added to 170, multiplied by one-half of 360, equals	48,600
Triangle ANG, 200 multiplied by one-half of 170, equals ...	17,000
Total	204,950

Deducting this from 543,200, the area of the rectangle, we have 338,250, or 3.38 acres, as the area of the irregular paddock.

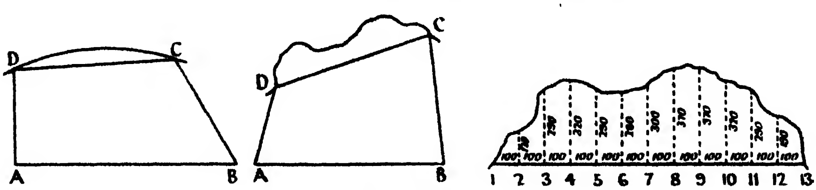


Fig. 26.

All the examples given are of paddocks with straight sides. Very often a boundary is not straight, being a creek or a railway curve or some other irregular line. Cut off the curved or irregular boundary by a straight line ranged across the paddock—see Fig. 26. The irregular portion may be cut off by more than one line if the circumstances make that course preferable. The result, however, of cutting off the irregular portion is to give a paddock with straight sides, the area of which can be obtained by the methods already given, and a portion, generally a narrow strip with one or more straight sides and an irregular boundary. The area of this may be found by measuring offsets, or the distances of the irregular line from the straight one, and applying to them a rule known as Simpson's. Divide the straight line after measurement into an even number

of equal distances. At each of the points thus obtained, including the two ends of the line, measure the distance to the irregular boundary; the distances should be measured at right angles to the straight line, found generally with sufficient accuracy by sighting. These measurements are called offsets. As the number of spaces was even, and measurements were taken at both ends as well as in between, the offsets must be an odd number. Now add the first and last offsets—those at the ends of the line—add all the odd-numbered ones and multiply the sum by two, add all the even-numbered ones and multiply them by four. Add all the results together, multiply them by the equal distance apart of the offsets and divide by three. In Fig. 26 the first and last offsets are each nothing, as the irregular line passes through the ends of the straight line; the third, fifth, seventh, ninth, and eleventh, the odd-numbered ones, add up to 1,540; this multiplied by two, gives 3,080; the even numbers, second, fourth, &c., yield 1,600 and multiplied by four 6,400. The sum of all these, 0, 3,080 and 6,400, is 9,480; multiplied by the distance apart, namely, 100, we get 948,000, and this, divided by three, gives 316,000 square links or 3.16 acres, the area of the piece in question. The distance apart of the offsets will depend upon the conditions and the amount of accuracy required. If the boundary be fairly regular or a curve, they may be as much as several chains apart. All areas found by the methods given will be in square feet if the original measurements are in feet or square links, if originally in links. Square feet may be turned into acres by dividing by 43,560, the number of square feet in an acre. Square links may be reduced by cutting off the last five figures, 10 square chains or 100,000 square links forming one acre.

MENSURATION MEMORANDA.

Cases will occur where measurements of areas of circles or similar curves are required. It will be convenient to group here for reference the properties of some of the more important figures and bodies.

The circumference of a circle, *i.e.*, the measurement around it, is the diameter multiplied by 3 and 1-7th, or the radius multiplied by 6 and 2-7ths.

The area of a circle is—the square of the diameter multiplied by .785, or, more roughly, 4-5.
the diameter multiplied by the circumference and divided by 4.
one-half the diameter multiplied by one-half the circumference.
the circumference squared and divided by 12.6, or multiplied by .08 or 7-88ths.
the radius squared and multiplied by 3 1-7th.

The area of an ellipse is the bigger diameter multiplied by the smaller diameter and multiplied again by .785 or 4-5ths.

The area of the surface of a sphere is the diameter squared and multiplied by 3 and 1-7th; that is, it is four times the area of a circle of the same diameter.

The volume of a sphere is the diameter cubed; that is, multiplied by itself twice running, and multiplied by .5236.

The area of the surface of a cylinder is the circumference, found as above, multiplied by the height; if necessary, add the areas of the circles forming the ends.

The volume of a cylinder is the area of the circle forming the base multiplied by the height.

The area of the surface of a cone is the circumference multiplied by the slant height divided by two, with the area of the base added, if required.

The volume of a cone and of a pyramid—that is, a body formed by three or more triangles meeting at a point and by a straight-sided figure forming the base—is the area of the base multiplied by the height and divided by three.

The volume of a frustrum of a cone or pyramid is the areas of the two ends added to the square root of their product, multiplied by the height and divided by three.

The volume of a wedge—that is, a body formed by five flat surfaces; two, the sides, being trapezoids, two, the ends, triangles, and one four-sided figure for the base—is the length of the edge added to twice the length of the base and then multiplied by the width of the base and by the height, and the result divided by six.

THE PRISMOIDAL FORMULA.

Excepting the sphere, all the solids referred to are cases of the *prismoid*. The prismoid may be described as a solid body having for its ends two parallel plane or flat faces and all other boundaries straight, that is, a straight edge placed on a boundary, should coincide with it from end to end. The great majority of solids, the contents of which may be required, are prismoids; exceptions are barrels, spheres, &c., all having bulging sides. The volume of a prismoid is found by adding the two end areas to four times the middle area, multiplying by the distance apart of the ends and dividing the result by six. The middle area referred to is the area of the body at a point equally distant from the two ends, and is not the mean of the two end areas. As a general rule, one practically applicable to all cases likely to occur in farm practice—four times the middle area is the same as the multiplication of the two end lengths by the two end breadths. Thus the rule becomes the multiplication of the end lengths by the end breadths, and of the addition of the two end lengths by the addition of the two end breadths, all added together; multiplied by the distance apart of the ends, and divided by six.

STACKS.

The practical application of these rules and formulæ will now be given. In the first instance, hay or straw stacks will be dealt with. One of the most common methods for calculating rectangular stacks—the one used by most insurance companies—is: Ascertain the length and breadth about half-way between the ground and the eaves, and find the height from the ground to the eaves and from the eaves to the ridge. The contents are found by multiplying the length by the breadth and by the mean height. The mean height is generally taken as the height from the ground to the eaves with one-third of the height from the eaves to the ridge added. Sometimes one-half the eaves to ridge height is allowed. The one-third method is never right, nor does it or the one-half method approach the truth, unless the walls are vertical and the ends of the top vertical and not sloping—an unusual form of stack. The error is always in favour

of the buyer; never of the seller. Using the prismoidal formula, the measurements required for a rectangular stack are the length and breadth at the ground and at the eaves; the height to the eaves, and from there to the ridge; and the length of the ridge. There are but few more measurements, and the results obtained are exactly correct. Take the following instance:—A stack of 50 feet by 10 feet at the ground, and 60 feet by 20 feet at the eaves, and 50 in length along the ridge. The length and breadth one half-way up are consequently 55 feet and 15 feet respectively. The height to the eaves is 10 feet and from there to the ridge 6 feet. The contents by the one-third method will be:—

55 multiplied by 15 equals 825. 825 multiplied by 10 feet, the eaves height with one-third of 6 feet, from eaves to ridge, added, that is by 12 feet, equals 9,900 cubic feet.

By the one-half method, it is:

825, as before, multiplied by 10 and 3, one-half the eaves to ridge height, that is by 13, equals 10,725 cubic feet.

By the prismoidal method, the stack is divided into two portions or prismoids, one part above the eaves, the top, and the other, the bottom, below the eaves. Following the rule given, the contents are:—

The top—breadth at ridge, 0 feet by length at ridge, 50 feet equals 0; breadth at eaves, 20 feet by length at eaves 60 feet, equals 1,200; sum of breadths at ridge and eaves 20 by sum of lengths at ridge and eaves, 110 equals 2,200.

The addition of these is 3,400; multiplied by the height, 6 feet, we get 20,400, and this divided by six gives 3,400 cubic feet, which are the contents of the top.

The bottom—breadth at eaves 20 feet by length at eaves 60 feet equals 1,200; breadth at ground 10 feet by length at ground 50 feet, equals 500; sum of breadths at eaves and ground 30 by sum of length at eaves and ground, 110 feet equals 3,300. The addition of these is 5,000; multiplied by the height 10 50 feet, 50,000; and divided by six, 8,333 cubic feet, the bottom contents.

Adding the top and bottom together, we have 11,733 cubic feet as the correct volume of the stack, as compared with 10,725 and 9,900 given by the approximate methods, nearly 9 and 16 per cent. below the truth (Fig. 27). If the stack have rounded ends, it may readily be converted into an equivalent rectangular stack by deducting one-fifth of the length of the rounded ends, and leaving the width unaltered. For instance, a stack is 30 feet long, with rounded ends starting to curve 5 feet from the ends. The length for the purposes of measurement would be the 20 feet of straight length with 4 feet (instead of 5 to allow for the curve) added at each end, or 28 feet in all. Width and ridge length would remain as measured. Circular stacks are generally small. An approximate rule is to multiply half the circumference, measured half-way between ground and eaves by half the diameter at the same point and multiply by one-third the height from the eaves to the peak added to the height of the eaves from the ground. If more convenient, any other of the methods given for finding the area of a circle may be used in place of the half circumference and half diameter one just given. The more exact way is, as before, to calculate in two parts top and bottom. The contents of the top are the circumference at the eaves multiplied by itself, multiplied

again by 7-88ths, and the result by one-third of the height from the eaves to the peak. The bottom is: the circumference at the eaves multiplied by itself, the circumference at the ground multiplied by itself, and the sum of the two circumferences, multiplied by itself; the whole three results added and multiplied by 7-88ths and by one-sixth of the height from the ground to the eaves. Add the top and bottom results together to get the total contents of the stack.

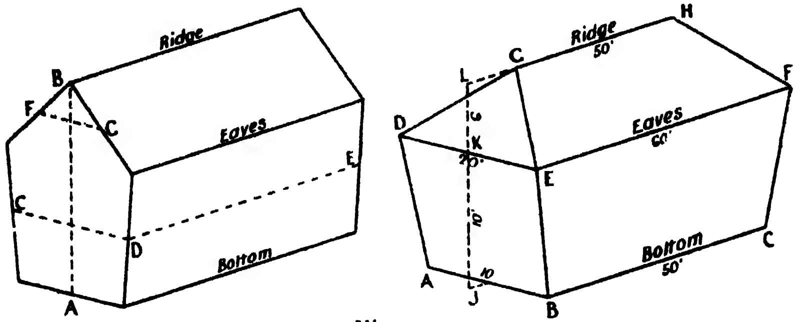


Fig. 27.

WEIGHT OF HAY, &c.

The results obtained by these methods are in cubic feet. The number of cubic feet to the ton is very variable, depending chiefly upon the size of stack, the time stacked, and the class. The best method, though a little troublesome, is to cut out a truss about half-way up the stack—the pressure there being about the average. Measure the contents of the cut in the stack, not the truss itself, and weigh the truss. This will give the weight of a cubic foot, and the total weight of the stack can then be set down with fair accuracy. The following table will be useful:—

If 1 cubic foot of hay weighs 8 lbs., 1 ton measures 280 cubic feet.
If 1 cubic foot of hay weighs 7 lbs., 1 ton measures 320 cubic feet.
If 1 cubic foot of hay weighs 6 lbs., 1 ton measures 373 cubic feet.
If 1 cubic foot of hay weighs 5 lbs., 1 ton measures 448 cubic feet.
If 1 cubic foot of hay weighs 4 lbs., 1 ton measures 560 cubic feet.
If 1 cubic foot of hay weighs 3 lbs., 1 ton measures 747 cubic feet.

If the truss method is not used, the following table will enable a fair guess to be made:—

Number of Cubic Feet to 1 Ton of Hay.

	Oaten hay		Wheaten hay.	
	Sheaved.	Loose.	Sheaved.	Loose.
New, just stacked	350	400	400	500
New, fortnight stacked ...	325	370	375	450
New, one month in stack ...	300	350	350	400
Old, last season's stack, from ...	300	325	320	400
" " " to ...	250	320	270	370

In some cases, coarse stalky hay will weigh even less than the worst figures given in the table. Allowance must be made for the thatch, if any, on the top, and for the inferior quality of stuff generally found near the ridge.

Tanks, &c.

Tanks, embankments, or excavation may be readily calculated by the prismoidal formula or the modification of it given. For tanks, where the water contents are wanted, or where the ground is fairly level at the top surface, multiply the length and breadth at the top—ground or water level as required—the length and breadth at the bottom, and the lengths at the top and bottom added together by the sum of the breadths. Add the three results and multiply by the depth and divide by six. In Fig. 28, with the dimensions given, the quantities are—

Top breadth, 60 feet by top length 100 feet, equals	6,000
Bottom breadth 20 feet by bottom length 60 feet, equals ...	1,200
Top and bottom breadths, 80 feet by top and bottom lengths 160 feet, equals	12,800
Total	20,000

Multiply by the depth, 10 feet, result 200,000, and divide by 6, giving 33,333, the number of cubic feet in the tank. To obtain the number of cubic yards, divide the cubic feet by 27, or to obtain gallons, multiply the cubic feet by 6¼. The same method will apply to a heap of broken metal or a bank, if the surface of ground at the bottom is level. If the surface be irregular, whether for a tank or an embankment, several vertical and parallel cross-sections, cutting the object into small portions, are required.

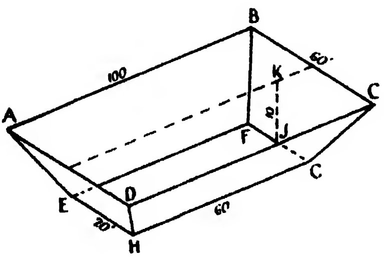


Fig. 28.

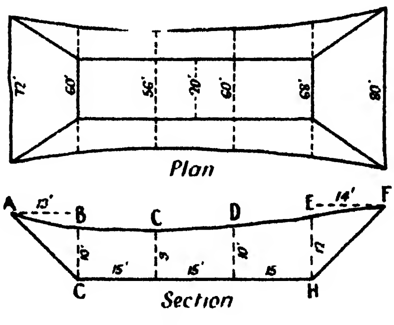


Fig. 29.

In Fig. 29 is shown a tank with surface very irregular; cross sections are taken as shown, and the excavation calculated in sections. The width at the commencement is 72 feet, and the depth, of course, nothing; the width at the first cross section is 60 feet at the surface and 20 feet at the bottom, an average width of 40 feet and the depth 10 feet. The contents of this first portion are—

Width 72 feet by depth 0, equals	0
Average width 40 feet by depth 10 feet, equals	400
Sum of widths 112 feet by sum of depths 10 feet, equals ...	1,120
Total	1,520

Multiplied by the distance apart of the cross-sections 13 feet, and divided by 6, we have 3,293.

The next portion, the second, is—

Average width 40 feet, by depth 10 feet, equals	400
Average width 38 feet, by depth 9 feet, equals	342
Sum of widths 78 feet, by sum of depths 19 feet, equals ...	1,482
Total	2,224

Multiplied by 15 feet, and divided by 6, equals 5,560.

The third portion is—

Average width 38 feet, by depth 9 feet, equals	342
Average width 40 feet, by depth 10 feet, equals	400
Sum of widths 78 feet, by sum of depths 19 feet, equals ...	1,482
Total	2,224

Multiplied by 15 feet, and divided by 6, equals 5,560.

The fourth portion is—

Average width 40 feet, by depth 10 feet, equals	400
Average width 44 feet, by depth 12 feet, equals	528
Sum of widths 84 feet, by sum of depths 22 feet, equals ...	1,848
Total	2,776

Multiplied by 15 feet and divided by 6, equals 6,940.

The fifth, and last portion is—

Average width 44 feet, by depth 12 feet, equals	528
Width 80 feet, by depth 0, equals	0
Sum of widths 124 feet, by sum of depths 12 feet, equals ...	1,488
Total	2,016

Multiplied by 14 and divided by 6 equals 4,704.

The total for the whole excavation is therefore 26,057 cubic feet, or 965 cubic yards.

Similarly any long excavation such as a channel, or banking such as a road formation, may be taken out by the modified prismoidal formula, with the certainty that the results are correct and not merely approximate with an unknown amount of error.

TIMBER, LOGS, &c.

For round logs, multiply length by the quarter-girth, multiplied by itself. This will give approximately the sawn timber result. To get the actual contents of the log, multiply length by the average girth multiplied by itself, and divided by 12.6, or multiplied by 7-88ths. A ton of firewood varies from 40 cubic feet, the selling rate, to 50 or 52 feet, buying rate. On the Murray River, the ton is 4 feet by 4 feet measured on the face of the stack, irrespective of the length of the wood. Thus 5-feet wood gives 80 cubic feet, and 2-feet wood 32 cubic feet to the ton. A cord of firewood is a stack 8 feet by 4 feet by 4 feet, or 128 cubic feet.

MISCELLANEOUS QUANTITIES.

A rod of brickwork is 30¼ square yards, that is 272¼ square feet, one brick and a half thick. Find the area of the surface in square feet; divide by 272¼; multiply by the number of half-bricks in the thickness of the wall, and divide by 3. Brickwork is now generally taken out in cubic yards. Metals frequently come into quantity calculations. One square foot 1 inch thick,

of wrought iron weighs	40.4 lbs.
of cast iron weighs	37.5 lbs.
of steel weighs	40.8 lbs.
of zinc weighs	37.5 lbs.
of brass weighs	43.7 lbs.
of copper weighs	46.2 lbs.
of lead weighs	59.3 lbs.
of gold weighs	100.0 lbs.

An equivalent volume of water weighs only 5.2 lbs. Five cubic feet of cast iron weight one ton. Rough and ready approximations for carting, or for widths of tires, are as follow:—

Hardwood, sawn, 800 feet super,		6 in. x 1 in.	— 1 ton
Sleepers	30	cubic feet	— 1 ton
Props	30	cubic feet	— 1 ton
Rails	40	cubic feet	— 1 ton
Posts	30	cubic feet	— 1 ton
Piles, in the round ...	35	cubic feet	— 1 ton
Piles, squared	30	cubic feet	— 1 ton
Stone, rough	14	cubic feet	— 1 ton
Stone, dressed	13	cubic feet	— 1 ton
Spalls	25½	cubic feet	— 1 ton
Road metal and screenings	23	cubic feet	— 1 ton
Pitchers	19	cubic feet	— 1 ton
Gravel	22	cubic feet	— 1 ton
Sand	25	cubic feet	— 1 ton
Lime	10	bushel bags	— 1 ton
Wool, pressed, greasy ...	6	bales	— 1 ton
Wool, pressed, washed ...	8	bales	— 1 ton
Hay, pressed	135	cubic feet	— 1 ton
Potatoes, 12 4-bushel or	15	gunny bags	— 1 ton
Bran and pollard ...	108	bushels	— 1 ton
Barley	11	bags	— 1 ton
Chaff	25	bags	— 1 ton
Flour	11	4-bush. bags	— 1 ton
Maize, whole	10	bags	— 1 ton
Maize, crushed ...	11	bags	— 1 ton
Oats	13	bags	— 1 ton
Wheat	9	bags	— 1 ton
Peas	9	bags	— 1 ton
Bricks	1000		— 3 tons

Steel Fencing Wire—

No. 6 gauge, 361 yards to 1-cwt. coil, 4 cwt. 3 qrs. 14 lbs. to 1 mile
No. 7 gauge, 428 yards to 1-cwt. coil, 4 cwt. 0 qrs. 13 lbs. to 1 mile

No. 8 gauge,	509 yards to 1-cwt. coil,	3 cwt.	1 qr.	23 lbs. to 1 mile
No. 9 gauge,	609 yards to 1-cwt. coil,	2 cwt.	3 qrs.	15 lbs. to 1 mile
No. 10 gauge,	747 yards to 1-cwt. coil,	2 cwt.	1 qr.	12 lbs. to 1 mile

Barbed wire—

No. 12 gauge, 490 yards to 1-cwt. coil, barbs 3½ in. apart.
No. 14 gauge, 770 yards to 1-cwt. coil, barbs 3½ in. apart.

Any reader finding difficulties in either field work or calculations should write to the Editor of the *Journal*. Full explanations or further information as required will be furnished by letter or by publication in the *Journal* if of sufficient general interest.

THE LAMB TRADE.

(Continued from page 121.)

A. A. Brown, M.B., B.S.

Conservation of Suitable Breeding Ewes.

An important matter in connexion with the building up of our flocks is the conservation of suitable breeding ewes, and it behoves every grazier to judiciously retain every year the numbers requisite for his purposes. If indiscreet disposal of ewe lambs suitable for breeding occurs, then there is no hope of the State acquiring vast flocks, and consequently the export trade must ultimately be contracted in extent.

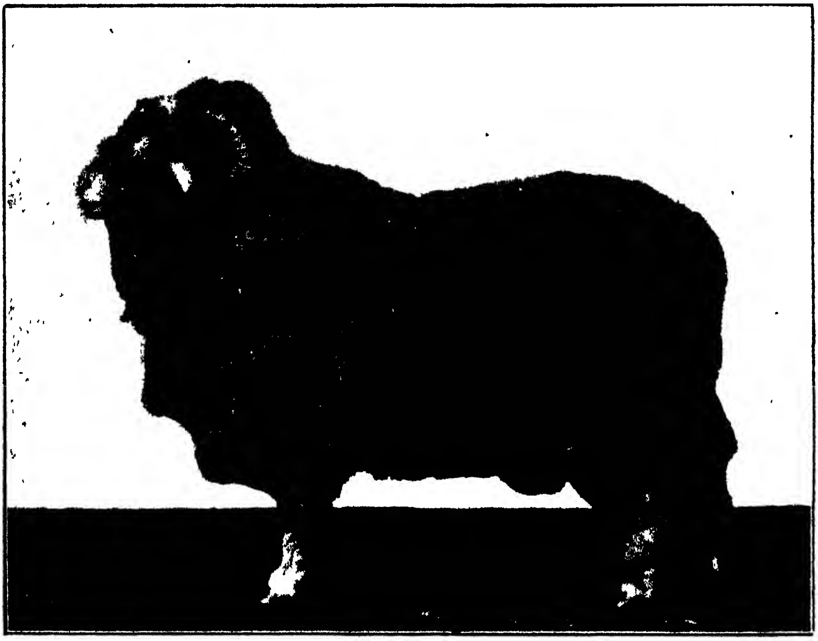
The lamb trade in New Zealand no doubt rapidly developed into a prodigious one, but its further expansion has, for a time at all events, received a decided check, in consequence of the shortage of breeding ewes in that country. There graziers are now keenly feeling the results of their indiscretion in not retaining sufficient breeding ewes to keep a prosperous trade on a constant level.

The judicious retention of sufficient breeding ewes is an important point to every progressive grazier. Where a national industry is at stake it appeals somewhat to all, so that legislation on the subject may be required to stop indiscriminate slaughtering of ewes. Every season one sees large numbers of ewe lambs at the slaughter-houses, and that in spite of the fact of the great difficulties that are found in securing ewes for breeding purposes. Graziers should jealously retain all suitable ewes capable of throwing lambs at least for another three years, until the country is amply stocked.

When tempting prices are offered to growers by the export buyers, it is perhaps only natural that they would be desirous of availing themselves of the opportunities of getting ready cash for their stock, hoping, of course, of being able to restock their estates from the flocks of breeders in distant districts, which the buyers do not frequent. Distant breeders, from various causes, may themselves, unfortunately, have parted with too many ewes, and, consequently, the frozen meat trade receives a decided set back from a general shortage prevailing.

BEST BREEDS OF SHEEP FOR MEAT EXPORT PURPOSES.

The question of the breed to employ to obtain the carcass that the meat exporter wants is a most important one, and it demands the exercise of considerable judgment. When wool raising was the staple industry, the Merino held sway, but now that the meat export trade has sprung into virile existence, early maturing breeds, better adapted to graze over the artificial pastures of smaller holdings, will find favour. Since the Merino breed has a great hold in Australia, graziers perforce must largely use the



MERINO RAM.

Good type for building up flocks intended to produce lambs for export.

ewes of this strain, and ewes derived from the Lincoln-Merino cross are perhaps the best under the circumstances to employ. There are districts where the Merino thrives to advantage, and in such districts good export lambs could be obtained from the crossbred Merino ewe. Climate plays a very important part in connexion with the question of breeds to employ, and the Merino undoubtedly suits the Mallee and the Wimmera. Perhaps the best breed to meet in all its aspects, the requirements of the meat export trade, is the cross between a pure bred Shropshire ram and a Lincoln-Merino crossbred ewe. The Lincoln ram, mated with a Merino ewe, produces a neat, compact, hardy, well-wooled sheep. This cross is less liable to lung or stomach worms than the pure Lincoln, or to foot-rot than the Merino. The Shropshire ram is then mated with a Lincoln-Merino ewe, and an ideal lamb for the London market is the product of the union. The selection of the ewe to breed from is an important matter. No ewes should be used for breeding unless they are of proper shape.

The ewes employed for breeding purposes should be deep, level, square, and roomy. The rams, in order to get the best results, should have roomy breasts and prominent briskets, and should be thick over the shoulders, back, and loins, and the head, which should be small, set upon a thick neck. Grade rams should be avoided, for the appearance of the carcasses derived from their employment undergoes such modifications that their value for export purposes is much depreciated.

STUD LINCOLN LAMBS.
The property of J. S. Mortimer, Esq., Katunga.

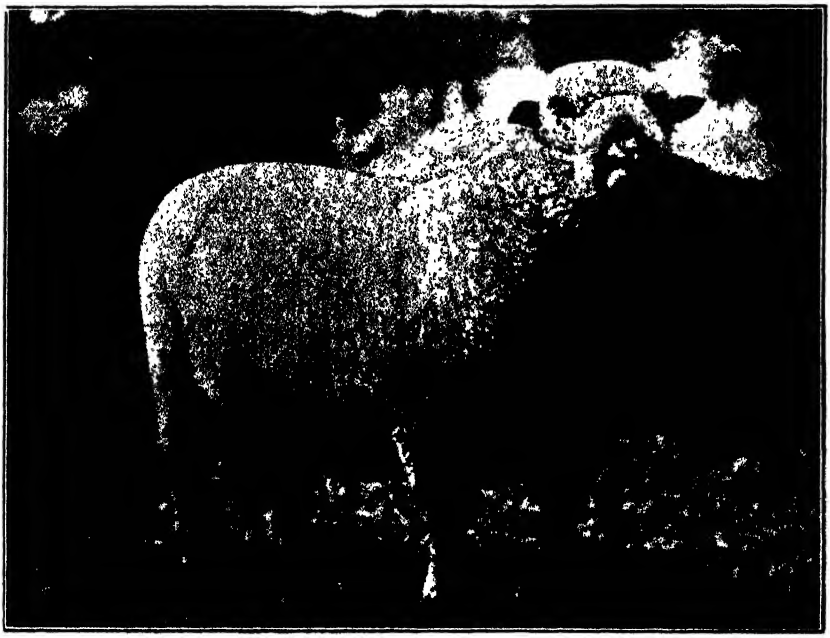
The Shropshire breed for meat export purposes is increasing year by year, but so far none of the pure breed have been exported, but have been reserved for stud purposes. Moreover, they are too expensive to export as meat Crosses of the breed are exported, and something like 25 per cent. of all lambs now exported are Shropshire crosses, which indeed are the most suitable lambs for export. When killed and dressed, their carcasses are plump and fleshy, with thick legs and shoulders. The carcass is well-invested with fat, which, however, is not laid on in a thick layer, but is distributed thinly over it, giving it a nice bright appearance. They are large-framed, fairly hardy, and exceedingly prolific sheep, fattening rapidly, and maturing early.

The Lincoln-Merinos are, as a rule, big carcassed sheep, and the ewes make excellent mothers, and the effect of crossing them with the Shropshire is to get a more evenly rounded and plump carcass. The Shropshire cross has the advantage that it tends to make all members of the flock present an even appearance. It however introduces a disturbing element in the wool industry that demands consideration. If a slump occurred in the meat export trade, a number of lambs would be left behind which, when adult, might prove unprofitable as wool producers, the wool being coarse and of a lower market value than the Merino or Lincoln breeds. Although Shropshires are producers of wool of a low market value, they are ready fatteners, and would be marketable in the following year as mutton for either export or local trade requirements. Whatever damage is likely to happen to the wool industry lies in graziers retaining crossbred Shropshire ewes for breeding puposes; but, in this connexion, it must be considered that the results obtained by breeding lambs for meat export will greatly outweigh in value any loss that may be sustained on the wool returns.

For breeding export lambs, some graziers favour ewes that are a cross between Merino rams and Lincoln ewes, whilst others favour the cross between the Lincoln ram and Merino ewe. Merino ewes, Leicester ewes, crossbred Leicester-Merino ewes, Comeback ewes, and Lincoln ewes, all

have their advocates as being suitable animals meeting all varying conditions to employ with a pure bred Shropshire ram.

It is, however, generally admitted that the cross between a pure Shropshire ram and Lincoln-Merino ewe is the best lamb to produce for lamb export purposes, and this cross will always command high prices, if prime.



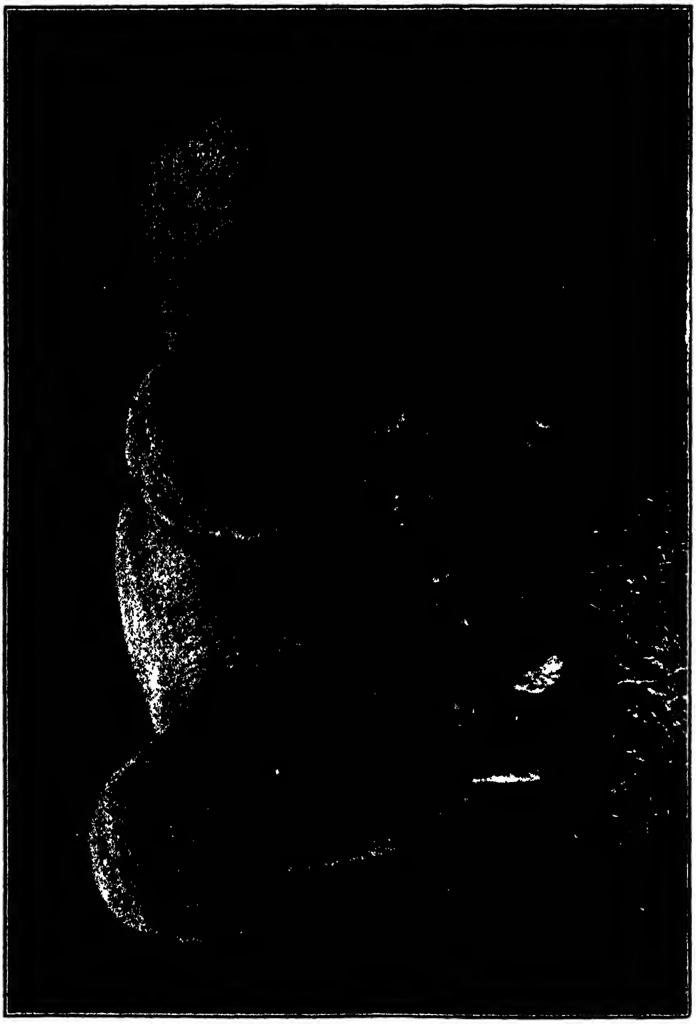
"ROSARIAN," CHAMPION SHROPSHIRE RAM.
The Property of R. C. Kermode, Esq., Mona Vale, Tasmania.

As far as the wool industry is concerned, so long as Shropshire ewes are not bred from, the quantity of Southdown wool offering would not be in sufficient amount to damage the wool market. With the breaking up of large estates in Victoria, wool production will, in a few years, give way to meat production, and the best breeds to meet such requirements must be gone in for. Farmers and graziers are more and more going in for raising fat lambs for export, and are induced to do so by the excellent prices that exporters have been offering for lambs fit for export, and they should be careful to grow what the exporter requires. Of lambs now exported something like 25 per cent. are Shropshire crosses, 65 per cent. are crossbreds (chiefly Lincoln- and Leicester-Merino), and 10 per cent. are Merinos.

Freezing Works in the State and Freezing Accommodation Afloat.

There are at present seven freezing works in the Metropolitan area, and three freezing works in the country, where meat is frozen for export. If shipments were made every week, something like 5,000,000 lamb carcasses could, with present equipment, be frozen yearly, provided the trade was carried on all the year round, and the works devoted exclusively to it.

The ships installed with refrigerating machinery that come to Victorian shores have a large carrying capacity, and, if a regular weekly service could be insured on all sides, then the freezing chambers ashore would not get congested. So long, then, as accidents do not happen to the regular departure of the ships engaged in the trade, there is, at present, sufficient space afloat to meet Victorian requirements. Should, however, a hitch occur to the departure of a vessel, as from some accident happening to its



YEARLING SHROPSHIRE EWES,

Bred by Geo. Simmons, Esq., Tasmania. [This and the two preceding illustrations are from photos. lent by Messrs. J. M. Peck and Sons.]

machinery, thereby causing delay in the removal of frozen produce from the chambers on shore, then a congestion of these chambers may take place that may occasion considerable inconvenience and an arrest of slaughtering operations, till the congestion is removed. It is when accidents arise that attention is drawn to the fact that the State could make use of more freezing space afloat, but, barring accidents, there is a fair regularity in

the transport of produce by the shipping companies, that meets with the approval of exporters of frozen produce. Tramp ships, installed with refrigerating appliances, call here for cargoes, but their arrival and departure is irregular and uncertain; nevertheless, these auxiliaries aid materially in transporting our produce to the world's centre. As time progresses, and the trade expands, more vessels, no doubt, will come into the regular trade; so no fear need be apprehended of difficulties arising in the way of efficient and quick transport.

SMALLER HOLDINGS.

There is steadily progressing in the State the breaking up of large estates, and this progressive tendency will lead to the establishment of industrious graziers who will control smaller areas, and who, in order to be successful, will require to bestow more care and management on their animals than did the large landed proprietor, who trusted entirely to the seasons. The pastoral industry in Victoria is now in a transition stage, and pastoralists are beginning to recognise that old methods must give way to new and improved ones. By the breaking up of large estates, and combining a system of agriculture with grazing pursuits, the productiveness of the land will be vastly increased. By laying down good pastures, the carrying capacity of the land will be increased, and there will consequently be a wider distribution of the wealth derived from the land. The average yield of wool in the grease when sheep receive proper attention will, no doubt, be increased, and a general average of ten pounds ought to be aimed at by all graziers. As showing what can be done on small holdings, the Secretary for Agriculture, New Zealand, in a report furnished in reply to inquiries on the subject, tells us what can be done in that country. He says:—

"In the Hawke's Bay district during the last year a farm of 180 acres, 22 of which were in rape, carried 700 ewes, and fattened both them, their lambs, and an additional 900 lambs, totalling in all 2,300 lambs and sheep that were frozen for export. An average crop of rape has carried 20 lambs to the acre for two months, and, after a spell, carried eight for a further two months. In this instance the seed was drilled in with about 1½ cwt. of bone-dust and superphosphate mixed. The Italian rye-grass has been found productive of excellent results, especially when rain has fallen in the months of February and March. Two and a half bushels should be sown to the acre, and the soil worked fine and well rolled. Such a pasture lasts two years, cutting a heavy crop of hay when sown in the autumn, and carrying with spells 12 sheep to the acre. Land sown broadcast in spring, with Italian rye and rape, and given 2 cwt. of dry blood manure, has been known to fatten 40 lambs to the acre, provided they were in good forward condition.

"Cape Barley and Oats.—Cape barley must have good autumn rains, failing which the crop is not usually remunerative. It comes more quickly, and is more fattening for young sheep than oats, but a crop of Algerian oats stands more feeding later in the season, and with a good rainfall and some short spells, carries from six to twelve lambs to the acre during the autumn and winter.

"A crop of Yellow Globe mangolds in this district, the winter before last, kept 100 sheep per acre for four months.

"A crop of lucerne carried quite fifteen sheep to the acre during the summer months.

"A crop of 20 acres of pumpkins of mixed sorts, sown without manure, and carted on to grass paddocks, carried 2,500 sheep from 1st May to 20th June. These sheep did remarkably well, and had the weather been less inclement, a large number would have come off fat.

"In the Poverty Bay district the flats simply in grass without fodder will carry about five sheep to the acre all the year round, with the addition of Cape barley, or green oats, double that number, with rape somewhat more, and with turnips fifteen to twenty. With a fairly good crop of pumpkins, from fifteen to twenty may be carried, provided the ground can be kept from getting too foul.

"The hill country in grass carried about two sheep per acre, but with assistance in winter with cultivation and fodder, that number could be doubled.

"In the Canterbury district it has been found that turnips will feed from 250 to 300 sheep per acre for a week, and that one acre will fatten about 30 sheep in ten weeks. Rape will carry from ten to twelve sheep per acre. Kale from fifteen to twenty, and Italian rye from twelve to fifteen."

If results such as narrated are possible in New Zealand, what could Victorian graziers achieve with their bountiful soils and salubrious climate?

DISEASES OF LAMBS.

Lung-worms and Stomach-worms.—Numbers of lambs are annually lost from lung-worms (Strongylus Rufescens and S. Filaria), and stomach-worms (S. Contortus), and, of those lambs that become infested and recover, most make but little progress for many months afterwards. The treatment for lung-worm is detailed in the *Agricultural Journal*, of July, 1903, and that for stomach-worm in *Agricultural Journal*, of June, 1905, in articles published by me on Animal Parasites.

Tape-worms.—In *Agricultural Journal*, of July, 1902, appears an article from my pen on tape-worms in sheep, and their treatment. Lambs generally contract the worms soon after being weaned, and the worms persist in their intestines until the animals are about two years old, when they begin to spontaneously forsake their hosts.

As preventives of worm infestation (lung-worm, stomach-worm, tape-worm) lambs should be weaned on turnips, rape, kale, or lucerne, since these foods tend to strengthen the system, and thus enable the lambs to resist invasion by parasites.

Intestinal Derangements.—Intestinal derangements caused by irritant herbage picked up on the pastures, intestinal parasites, &c., are a source of fatalities to lambs. Two to three ounces of linseed oil should be given to clear out ordinary irritant matters from the intestinal tract, and the lambs transferred to good pastures. The treatment for parasitic invasion should be perused in the Journals indicated, and the remedies recommended adopted.

Tetanus or Locked Jaw.—Tetanus is a condition due to a specific germ. To prevent tetanus after lamb marking or castration, Stockholm tar should be applied to the injured parts.

Navel Ill.—Navel Ill is occasionally seen in lambs, but it is by no means of frequent occurrence. It is a septic condition that supervenes on the umbilical wound, where such wounds are left to take care of themselves. In the case of valuable animals, the wounds in the newly-born should be dressed with Friar's Balsam to prevent infection occurring.

Sheep Blow-fly (Calliphora Villosa).—To prevent the blow-fly from striking the ewes and even the lambs, all parts of the animal liable to be soiled by natural discharges of the body, should be shorn of wool, and then dressed with fish oil containing traces of iodoform.

DAMAGE TO LAMBS FROM GRASS-SEEDS.

Besides having to contend with droughts, diseases, and the depredations of rabbits, graziers have yet another formidable enemy, *grass-seeds*, to reckon with. Lambs running on lands where the grasses are long, and the seeds spearlike, often sustain considerable injury through the seeds penetrating their skins. Grass-seeds are a terrible scourge to graziers. At seat of entrance of seeds there is inflammation, ending, perhaps, in pus formation. When the pelt is removed many seeds may be found sticking in the subcutaneous tissues, and it may be that the inflammation has extended deeply into those structures. The carcasses often present an appearance as if the animals had suffered from an eruptive disease. The damage done to lambs by grass-seeds is tremendous, and, so long as sheep are depastured on wide tracts of country, there is not likely to be any means of preventing the damage. In consequence of the inflammation caused by the seeds being in some cases so extensive, such carcasses are condemned.

As time progresses, and pastoral lands become more valuable, and when huge tracts of country are split up into smaller areas, and when water is better conserved, and its supply more certain, and when grasses and other forage crops are grown to feed sheep, then perhaps the grass-seed trouble may be relegated to the regions of oblivion.

RABBITS FOR EXPORT.

During 1905 over ten million rabbits were landed in London, worth £268,000, in addition nearly twelve million skins, worth another £50,000, were exported, bringing the total value of the trade to considerably over £300,000.

Freight to London varies from time to time from 1s. 6d. per crate up to 2s. (last season it touched as low as one shilling).

The charge for freezing comes to 1s. 9d. per crate of twelve pairs.

Railway freight depends on distances; the average cost is about 1d. per pair.

Export rabbits are put up in two grades; the first grade in black branded crates; the second grade in red branded crates.

First grade rabbits are divided into three classes, "Large," 2½ lbs. and over; "Young" 2 lbs. and over; and "Small" 1½ lbs. and over. Corresponding weights are packed in the red crates, but are designated as "Size 1," "Size 2," "Size 3."

At certain times of the season one or other of the two lower weights of the second grade are dropped and packed as skinners.

In the case of furred rabbits, twelve pairs are packed in each crate. In the case of skinners, 30 or 36 are packed in a crate.

The consolidated charge of 1s. 9d. per crate covers the cost of package, grading, packing, handling, freezing, 21 days' storage and shipping.

R.C.

STRAWBERRY CULTURE.

James Lang, Harcourt.

In making a new plantation of strawberries virgin land should be selected if possible, or, failing that, land that has been down in pasture for a few years is the next best. It has been the experience of most strawberry growers that land which has been in cultivation for a few years does not produce good crops of fruit. A rich loamy soil is one of the best for strawberries, although some varieties thrive well on a stiffer soil, and good crops have been obtained from very sandy soils, in the granite soils of Harcourt good crops of fruit have been grown.

In preparing the land for planting, it should be ploughed in the spring-time to a depth of 9 or 10 inches, and allowed to lie fallow till the summer. If weeds should appear, give a good scarifying with the disc scarifier, and then level all down with the ordinary harrow. About the beginning of March a second ploughing should be given, and the land gathered into lands 24 feet wide if the soil is dry, and lands half that distance if the soil is at all damp; give a good harrowing, and the ground is then fit for planting as soon as rain comes.

The earlier the plants can be got in the better for a good spring crop. They should be planted in rows, 3 feet apart, and about 1 foot in the rows from plant to plant. This gives plenty of room for cultivating with the horse hoe. In small plantations where the work is done by hand, 2 feet apart in the rows would be sufficient. After the plants have been put out, it is necessary that they should be kept clean from weeds. On this depends a good deal of the success of the plants the first year, and will involve a good deal of labour in hoeing and weeding; weeds take a good deal of killing in the winter time. Keep the beds all clean and free from weeds in the spring time when the plants are in bloom. It will then be necessary to mulch the plants with straw to keep the fruit clean. Some growers mulch with long stable manure, but this is objectionable. Others use spent tan from the tanneries, but it is apt to promote fungoid growths, which are detrimental to the plants. On the whole, clean straw or dry grass is much the best material to mulch with. During the summer keep the hoe going occasionally to keep the weeds down.

In the second year, about the end of April or beginning of May, the plantation should be lightly ploughed by running a furrow alongside the plants, turning the furrow towards the centre, and then down the opposite side. This leaves a ridge down the centre of the rows and keeps the plants dry during the winter. In the early spring the rows should be ploughed again turning the furrow back towards the plants on either side; this leaves the ground fairly level again. Before ploughing, it would be advisable to give some orchard manure, about 6 cwt. to the acre. This manure contains all the ingredients of a complete manure, and is, therefore, much better for fruit than bonedust or superphosphate alone. Keep the horse-hoe going to keep the weeds down, and when the plants are in bloom, mulch again with straw as in the previous year. It is advisable to make new plantations every three years, as when plants get older than that they are generally attacked by the larvæ of a beetle which eats out the crown. They are then best rooted out.

IRRIGATION.

Where water is available for irrigation, the fruiting season can be greatly prolonged. In laying out the beds with a view to irrigating the plants, it is necessary that the rows should have a fall one way, so that the water runs freely down the rows. Where plantations are made on the sides of steep hills, the rows should be run diagonally across the fall of the hill, allowing a fair fall for the water to run. Where this is done the water soaks in as it runs along the furrow, whereas if the plantations are planted straight up and down the hill, the water will run rapidly off, doing very little good. A shallow furrow should be made with the plough down every second row. The water should be brought along the top of the bed as nearly level as possible. The furrows that run down the rows should be joined into the channel that carries the water; at the junction of the two you will have to put in a weir to regulate the supply of water to each furrow. The weir is made as follows:—Get a small wisp of dry grass, and put it across the top of the furrow, mix some of the soil with the grass, and press down in the middle till the water runs over the top just sufficient to reach the bottom of the furrow. These off-takes are very simple, and, if properly put in, will last for the whole season; the writer has used them for many years. You can always regulate the supply of water into the furrow by pressing the weir down, and raise it a little if you have too much water, see Fig. 1. The dotted lines represent the rows of plants, and *a*, *b*, *c*, and *d* the water furrows:—

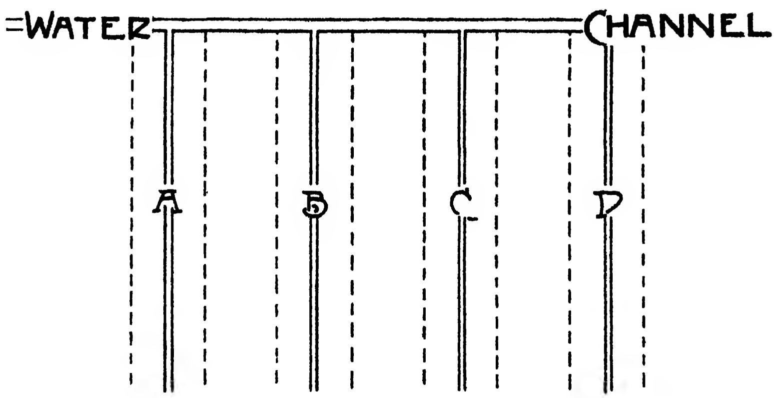


Fig. 1.

Where the rows run diagonally across the fall of the hill, a different method may be adopted. Bring the water along to the highest part of the bed, then get sufficient galvanized iron down piping, 3 inches in diameter, which is obtainable in 6-ft. lengths. Lay the first length with the mouth in the water channel, and butt another length on to the bottom of the first one, leaving a small space just sufficient for enough water to escape to run down the furrow. Continue on in the same way till you get to the foot of the hill. By using the down pipe down the steep part of the hill, it avoids the scour that would take place if a stream of water was run in a furrow straight down the hill. By moving the pipe

at each joint, you can regulate the supply for each furrow. See Fig. 2. Three-inch down pipe can be bought in Melbourne for about 1½d. per foot. As the water furrows are 6 feet apart, the 6-ft. down pipe is just the length.

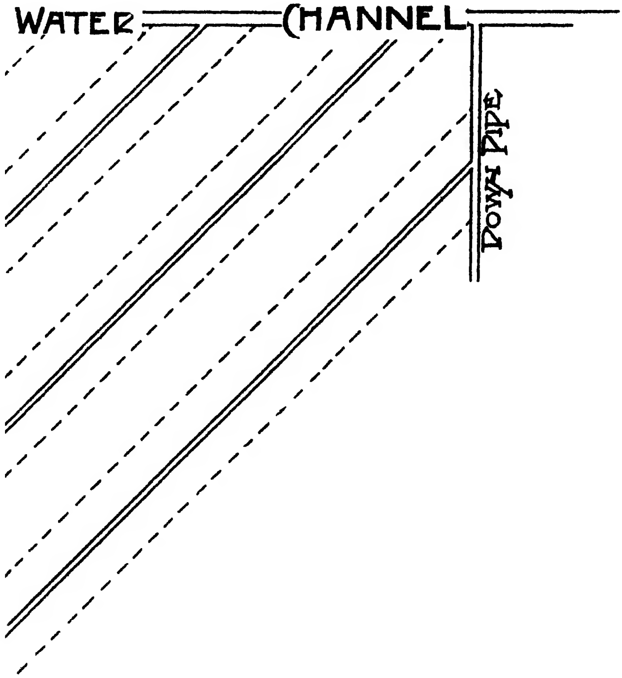


Fig. 2.

If the rows are very long, the top of the rows at the channel are likely to get too much water. If so, it would be better to do it in two sections. When the upper section has had sufficient water, another channel could be brought across the middle of the bed and the lower part watered in the same way as the first. In running the water down every second row, it leaves the other rows open to gather the fruit.

With regard to the most suitable varieties for planting, there is very little choice. The La Marguerite of French origin is one of the oldest varieties and is still the best for market purposes. Trollope's Victoria does well on stiff clayey ground and is very firm in the flesh and carries well; not so large, but later than Marguerite. Edith Christy, a Victorian seedling, grown by Mr. F. C. Christy, and named after his daughter, is an early variety of good size and flavour, rather pale in colour, and soft flesh, crops well. Uptutmark is a new variety, which originated at Doncaster, and is well spoken of in that district, having the character of bearing good crops all through the summer. The varieties Captain, Sharpless, Noble, and Royal Sovereign, do fairly well in some places, but are not to be depended upon.

In the early days of strawberry culture in this State, the varieties, Myatt's Surprise and Carolina Superba, gave immense crops of fruit, and

I question very much if the yields given by these varieties have been equalled since. It may perhaps be worth while for growers to give these old varieties another chance if plants can now be obtained. A great number of new varieties have been introduced from England and America from time to time; but none of them have proved of much value for market purposes; there is still an opening for some good new varieties of strawberries.

GARDEN NOTES.

J. Cronin, Inspector, Vegetation Diseases

The Delphinium.

Delphinium, the larkspur, is a genus that includes annual, biennial, and perennial species, most of which produce flowers of varying shades of blue. The annual kinds, mostly varieties of *Delphinium Ajacis* (the rocket larkspur), and *D. consolida* (the branching larkspur), are hardy plants that are largely grown for sale and for garden decoration. They are very showy, and in addition to blue, produce flowers of pink, white, purple, and other colours, and double or single individual blossoms. The rocket varieties are said to contain a principle that is poisonous or obnoxious to certain insects, and are often specially planted in gardens in districts subject to invasions of grasshoppers as a check against their ravages. Seeds of the annual kinds should be sown in autumn.

The perennial kinds are worthy of general cultivation, particularly the florists varieties, of which those known as Kelway's hybrids are the finest. There are species such as *cardinale*, and *nudicaule*, that bear scarlet and crimson flowers, and *sulphureum*, the yellow flowers of which are used for dyeing silks in Syria, but it is on account of their beautiful shades of blue that Delphiniums are specially valuable as garden plants. The flowers are borne on spikes often 5 feet in height. The colours of the newer hybrids are almost indescribable, and embrace almost every possible shade of blue and purple. There are single and double flowered varieties. In addition to the greater variety of colour, the garden varieties are larger in spike and flower, and generally more floriferous than the parent species. They endure great heat without flagging in the least, if supplied with a fair amount of moisture, and in fact there is no flower grown in our gardens that can compare with Delphiniums in that respect.

CULTURE.

To grow Delphiniums well they should be planted in beds specially prepared for them; sheltered from rough winds, but not unduly shaded or close to large trees. They thrive best in a friable loam that has been deeply worked and well manured. Rotted stable manure is most suitable in such soils; a mixture of equal parts of rotted cow and stable manure for soils of a sandy nature. The plants need a fair amount of water during summer, and as little as possible during winter, so well drained beds are essential. The beds should be prepared during winter, and the

plants set out in spring, in rows about a yard apart, planting about two feet apart in the rows. The beds should be mulched early in the season, by which means strong plants are assured in one year, even without the application of much water. The stems are brittle, and one stake at least will be required for each plant. After the main shoots have bloomed they should be cut away unless required for seed (which should be saved from the main spike of the finest kinds only) after which the side shoots will flower. When the stem has finished blooming it should be cut to the ground, when other shoots will soon follow. Delphiniums are most effective in mixed borders, in which they should be planted well back from the edges.

"Miss Gower" (*Kelway hybrid*)—*Single Variety—Bright Blue, with White Eye.*

"Capt Holford" (*Kelway hybrid*) —*Double Variety - Dark Purplish Blue.*

Propagation

Old plants should be carefully divided in spring, leaving one or more crowns to each division. Small pieces even if not supplied with roots will grow into fair plants, but require more attention in watering and cultivating. Delphiniums are easily raised from seed, which should be sown in autumn and winter in boxes or pans of fibrous sandy soil. A succession of young plants will insure flowers during the whole of the summer and autumn, the plants blooming a few months after the seed is sown. Slugs and snails, if present, are sure to attack the young plants, and provision must be made to prevent their access to the young seedlings. If no such enemies are present, the seed may be sown in the open ground, and the seedlings transferred to their flowering quarters when about two or three inches in height.

Flower Garden.

During this and next month most of the horticultural societies in the State hold their annual exhibitions. The floral exhibits are becoming more popular each season, especially at fruit shows, the principal flowers shown being roses, dahlias, and chrysanthemums. Cactus dahlias especially are exhibited largely during March, and with roses and chrysanthemums are an important feature at the shows held in April. At most of the shows examples of high culture may be seen, and cannot fail to be of educational value generally. To be successful an exhibitor must pay special attention to his or her plants. The whole energy of the plants, excited by stimulants, must be devoted to the production of a few blooms. Often the stimulating process is overdone, and coarseness and lack of quality are the result. This is generally the case where the plants are over-vigorous with large foliage and soft shoots. Such plants should not receive any special "feeding" whatever, neither should poor and weakly plants be persevered with, as all the "feeding" possible will not cause them to produce good blooms. The plants that will produce high examples of culture under special stimulation, are those of moderate strength, carrying well-ripened shoots; and the lesson to be learned at our shows is that from trees of a like character the best examples of fruit are obtained. A liquid manure that is suitable for plants requiring such "feeding" may be made from Peruvian guano, used at rate of 1 oz. to two or three gallons of water. The weaker solution should be used when commencing to "feed" the plants, increasing the strength gradually. Once weekly is often enough to apply liquid manure, sufficient being given at each application to moisten the soil thoroughly. An occasional watering with soot water, prepared by suspending a quart of coal soot (tied in a piece of hessian) in 10 gallons of water, is beneficial, especially to the foliage, which must be maintained in a healthy condition to assimilate the plant food.

Daffodils and other spring blooming bulbs should be planted. The depth to plant should be regulated by the size of the bulbs; small bulbs, as Ixias, near the surface, say about two inches deep; larger to a depth of six inches.

Seeds of hardy annuals may be sown for early blooming, and spring flowering herbaceous plants, as primroses, increased by division of the crowns, choosing moist weather for the purpose.

Kitchen Garden.

If the weather conditions are favorable, plant out cabbage, cauliflower, and other vegetables, that will be required for winter use. If the plants of cabbage or cauliflower are infested by aphis or caterpillars, dip before planting in a solution of "Firtree oil." The "blight" and "grub," as these pests are usually termed, have been very troublesome in many places this summer, and it would be of little use to set out infested plants. Of several washes that were tried against cabbage aphis some years back, "Firtree oil" was in a very marked degree the most effective, in fact it was the only wash that was at all satisfactory. It is too expensive to use as a spray wash except on plants in seed beds, but used as a "dip" it is reasonably cheap, and was proved to be effective.

Seeds of various saladings, also turnip, cabbage, and cauliflower, should be sown for a succession.

SMALL YIELDS OF VICTORIAN VINEYARDS AND THEIR CAUSES.

FRANÇOIS DE CASTELLA.

A large portion of the produce of our vineyards is destined for shipment to England. This market is at the greatest possible distance from us, and we have to compete against wines grown much nearer to it, and under more favorable conditions as regards cost of labour, as well as cost of transport. It is only by doing our utmost to maintain a high standard of quality, and at the same time by reducing the cost of production to the lowest possible figure, that we can hope to compete successfully with our more fortunately situated rivals in Southern Europe and Northern Africa.

One of the most potent means of reducing the cost of production is by increasing the annual yield per acre. It is evident that even a small increase in yield is absolute profit, if it can be obtained without any increase in the cost of cultivating the vineyard. I refer, of course, to a reasonable increase in the yield, and one that can be obtained without in any way impairing quality; by unduly forcing production, either by excessive irrigation or a too lavish use of powerful manures, quality might suffer; but we have only to compare our average Victorian yields with those of some of the choicest European vineyards in order to be convinced that there is ample room for improvement.

All practical vine growers know that it frequently happens that an abundant vintage is noted for a high standard of quality. In our generous climate we have nothing to fear from a very considerable increase in the yield of our vines, for the reason that, in the majority of cases, their average yield is, at present, far too low.

No comparison is here intended with the abundant vineyards of the South of France, where yields of up to 3,000 gallons per acre are not uncommon. The type of wine produced there would be useless to us except, possibly, for distillation. Although suitable for home consumption were we a wine-drinking people which, unfortunately, we are not, they would be quite unfit for export.

Taking into consideration only the vineyards producing the choicer European wines, and planted with varieties which we have found by long experience to be suited for the production of the type of wine for which there is a ready demand in Great Britain, we are at once struck by the fact that with few exceptions our vineyards compare very unfavorably with them, so far as productiveness is concerned.

Now that Phylloxera is forcing many vinegrowers to consider whether they will abandon viticulture or re-constitute their vineyards with grafted resistant vines, this question of our small yields becomes one of vital importance, and we must do our utmost to see that nothing is neglected that may tend to increase the yields of our re-established vineyards. The consideration of the causes of these small yields is thus forced upon all growers who seriously face the question of re-constitution.

These causes may be divided into two main groups:—

1. Mistakes made in connexion with the establishment of the vineyard.
2. Faulty or unsuitable cultural methods.

At the present time of year it is the first group which interests us most. It will ere long be necessary to make up one's mind with regard to plantations to be made during the coming winter and spring.

Mistakes made in Connexion with the Establishment of the Vineyard.

Chief amongst these we have the following:—

1. Insufficient preliminary preparation of soil prior to planting.
2. Deterioration of the vine, owing to faulty selection of cuttings.

There are doubtless others also, such as selection of varieties unsuited to the climate or soil. Vineyards are sometimes planted in unsuitable situations, but these mistakes, though grave, are made by inexperienced growers and they only merit passing notice.

INSUFFICIENT PRELIMINARY CULTIVATION.

Though, perhaps, the most important of the factors, this subject has been so thoroughly dealt with by Messrs. Dubois and Wilkinson in their introduction to the translation of articles on *Trenching and Sub-soiling for American Vines*, published in 1901 by the Department of Agriculture, that I cannot do better than refer growers to this excellent work. It will bring forcibly before them the difference between the methods we have followed in the past and those used in European wine countries. The translators especially insist on the greater need for *preparatory deep cultivation* in the case of grafted resistant vines, and refer to the many failures which in France resulted from neglect of this indispensable work. The grafted American vine demands far more attention in this direction than the ungrafted European. This point is now thoroughly recognised in Europe, and should not be lost sight of by Australian growers.

DETERIORATION OF OUR VINES, OWING TO FAULTY SELECTION OF CUTTINGS.

Little or no attention has been paid to the selection of cuttings by the bulk of our growers, more especially during the very active extension of the area under vines brought about by the bonuses given in 1890, and subsequent years. During this period, almost any part of a vine was looked upon as being good enough for the purpose. New chum viticulturists prided themselves upon the number of cuttings they could plant in a day, but paid no attention to their selection. An intending planter would order his cuttings from any vineyard proprietor who would supply him at a cheap price; this grower would allow his vignerons a few shillings per thousand for trimming, and making them into bundles, but their careful selection was the last thing that entered the head of either purchaser or vendor. The former could consider himself lucky if the cuttings were freshly removed from the vine, nor was the vendor always to blame for this; orders were often sent in at such short notice and so late in the season that there was no option but to execute them from heaps of vine prunings ready for burning.

If the percentage of strikes was fair, and the bulk of the young vines proved true to type, the grower congratulated himself upon having a well-established vineyard.

The results of such haphazard methods have been most serious, so far as the yielding power of our vines is concerned.

The importance of the most rigorous selection in every branch of agriculture, in order to improve breeds and varieties, whether of animals or plants, is universally recognised, yet nothing has been done in this direction in Australia, so far as the vine is concerned. There is not the slightest doubt that in very many cases the varieties or "cépages" cultivated, have absolutely deteriorated owing to reckless propagation.

The tendency of higher plants to "sport" is well known. It occasionally happens that a certain bud will suddenly, and without apparent cause, give rise to a shoot yielding leaves, flowers, or fruit differing in some particular from the type. If removed in the shape of a cutting this deviation is perpetuated, and we have a "sport" from the parent plant. Many choice varieties of roses have originated in this way, and in the case of vines and fruit trees this tendency has often been turned to useful account, in order to modify the size, or colour, or other qualities of the fruit. For example, the "Centennial" grape is a sport from the Waltham Cross.

We can thus perpetuate variations from type of a desirable nature, but undesirable characteristics are also perpetuated in the case of a cutting made from a faulty shoot.

All works on viticulture insist on the necessity of only making cuttings from canes which have borne fruit, the presence of a small piece of the previous year's wood at the base being recommended, as it indicates that this requirement is fulfilled, and the cutting is not merely a sucker off the old wood, or "gourmand," and thus incapable of having borne fruit. In the case of certain cépages, cuttings made from non-fruit-bearing suckers produce absolutely sterile vines,* and in every case the vine resulting from such a cutting is certain to be less prolific than one derived from a fruit-bearing cane.

It is evident that the haphazard propagation of so many of our vines, already referred to, is responsible for the planting of a large number of cuttings which were quite unfitted to produce a prolific vine.

It is only necessary to take a walk through almost any of our vineyards to be convinced of the truth of this. The difference between the yield of individual vines in a block planted with the same variety is striking. Some will bear a heavy crop of well-filled bunches; others, though equally vigorous and equally well pruned and cultivated, bear only a few bunches; on others again, the bunches, although numerous, are so badly filled, owing to the non-setting of many berries, as to be almost valueless. As a rule these differences are noticeable year after year, the vines which bear heavily in one season continuing to do so subsequently. It is evident that cuttings taken from inferior or unproductive vines will tend to reproduce the undesirable peculiarities of the parent.

In old vine-growing countries it has for centuries been customary to mark such useless vines at vintage time, so as to permit of their elimination and replacement with fertile ones. In the Moselle district of Germany it is usual for the grape pickers to break back the upper portion of the canes of all undesirable vines. Needless to say, vines thus treated are carefully avoided as cutting producers. They are gradually eliminated from the vineyard. In the older works on viticulture, published prior to the era of reconstitution on Phylloxera resistant stocks, grafting is chiefly referred to as an excellent means for the conversion of such useless vines into prolific ones.

* See Dr. Jules Guyot—*Etude des Vignobles de France*, Vol. II., p. 361.

Certain cépages are more liable to this deterioration than others. Take the "Syrah" for example, so largely cultivated in Australia under the name of Shiraz or Red Hermitage. In his standard work on Viticulture, Foex,* after recognising it to be one of the most valuable kinds, says, "It has, however, the defect of degenerating easily, and cuttings should be selected with the utmost care before planting. It is the diminution in the volume of the fruit resulting from bad choice of canes destined for its multiplication, and from (cultivation under) unfavorable conditions, which has given rise to the erroneous idea that there exist two races of Syrah; a large and a small."

The Chasselas is another sort which degenerates easily. There is scarcely a vineyard in Australia where one may not note great differences between the fertility of different vines in a block planted with this variety: certain vines never set their fruit properly, whilst adjoining them are to be found plants which produce, year after year, good yields of well filled bunches. I well remember when a boy, at St. Hubert's, Lilydale, accompanying my father, while, with a pot of paint and a brush, he marked any exceptional vines which he intended to use as cutting producers for future plantations.

Although all cépages do not deteriorate to the same extent, there is not one which will not benefit by careful selection, nor is there one of which unsuitable cuttings can be planted without certainty of disappointing results.

A few extracts from a striking article which appeared in a French periodical some years ago, dealing with this subject, may not be out of place.† The writer, M. Battanchon, points out the urgent necessity for carefully selecting the scions to be grafted on resistant stocks. After insisting on the need for stocks suited to soil and climate, and for proper affinity between stock and scion, he continues—"But it is upon the good choice of the scions—and this independently of the French variety employed—that the yield, and more especially the regular yield of the reconstituted vineyard, will depend in the largest measure."

He compares a large estate, where grafted rooted vines, purchased by the thousand in the open market, have been planted with every care and skill, with the small vineyard of a careful and intelligent vigneron, who does everything himself, and works his own stock. Though vigour of vegetation and careful cultivation are equal in each case, there is a considerable difference in the yields. In the big vineyard one sees every here and there, faulty vines, with few or badly set bunches, whereas in the small one there is not a vine which is not loaded with well filled bunches. He goes on to describe how the small grower achieves such good results:—"In the spring he marks the vines which come into leaf latest, in autumn those which have set their fruit best. . . Which are most productive, and which ripen earliest . . and this year after year. . . In this way he gradually eliminates everything that is indifferent or only passable, keeping only that which is very good, and it is solely from these vines, which combine the maximum of qualities of all kinds, that he cuts the canes which are to serve as scions. He even goes further. Before vintage he once more goes through the vines which he has marked, and

* See *Cours Complet de Viticulture.*—G. Foex.
† G. Battanchon in *Messager Agricole*, 10th January, 1903.

observes the shoots which bear most fruit. *It is only these shoots that he will choose.*"

According to M. Battanchon:—"It is only necessary to compare the vines reconstituted with due regard to this point with those where it has been neglected, in order to be so struck by the difference as never to forget it."

The importance of the careful selection of scions is so well recognised now-a-days, in France, that Messrs. Viala and Ravaz, in the valuable work recently translated by Messrs. Dubois and Wilkinson, express themselves as follows concerning it.*:—

"We need not insist on the selection of scions. They should only be cut from those canes which bear the most fruit, and from the most fertile vines. They should never be taken from young vines which have a tendency to produce wood instead of fruit, and which are never well lignified; nor from vines affected by cryptogamic diseases, which are always deficient in reserve material, and consequently incapable of forming much callus."

In conclusion, let us hope that reconstitution may not prove an unmixed evil, but that in leading to our re-established vineyards being planted on better prepared soil, and with vines rendered more productive by rigorous and carefully carried out selection, our growers may, in an increased yield per acre, find some compensation for the sacrifices forced upon them by the Phylloxera and the re-planting of our vineyards which it renders necessary.

THE MARKET FOR VICTORIAN PRODUCTS.

R. Crowe, Superintendent of Exports.

The following Table shows the Total Amount of the Imports into the United Kingdom of Products which are specially adapted for Production in Victoria.

During the Years 1904–1905 the Imports from outside Countries averaged £180,000,000 in value. Of this amount Victoria contributed 3 per cent. It will be seen that Great Britain presents almost an unlimited market for our produce.

Product.	Total Imports into the United Kingdom. 1904.	Total Imports into the United Kingdom. 1905.	Imports of Victorian Production, 1905.	Per cent.
Grain and Flour (not including Rice)	£67,330,187	£68,730,352	£1,276,213	1.85
Dairy Produce	59,656,295	60,796,773	1,898,986	3.12
Meat	30,585,333	31.5 0,323	339,027	1.07
Fruit	11,822,464	11,913,127	69,054	.58
Wine	7,830,431	8,336,959	72,403	.86
Rabbits	780,737	835,929	267,860	32.04
Total Food Products ..	£178,005,447	£182,143,463	£3,923,543	2.15
Wool	20,366,030	23,821,359	3,376,015 (1904)	14.17
Tallow, Hides, and Skins ..	6,576,310	8,084,824	1,058,040	13.08
	£26,942,340	£31,906,183	£4,434,055	13.89
GRAND TOTAL VALUE ...	£204,947,787	£214,049,646	£8,357,598	3.09

* *American Vines—Their Adaptation, Culture, Grafting, and Propagation,* by Viala and Ravaz, p. 244.

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SUMMER PRUNING.

C. B. Luffmann, Principal, School of Horticulture and Small Farming, Burnley.

THE PRINCIPLES INVOLVED.

Fruit trees of all kinds yield the best average crops where their branches are thinned, stopped, or otherwise dealt with from year to year. Any cutting done whilst the head is leafless, or making no visible movement, tends to strengthen the tree, by reason of the same amount of root action as formerly expending its energy on a smaller number of branches. Further, new buds are possessed of greater energy than old ones, hence where sap forces their development, clean and direct channels are made for the passage of sap.

The amount of sap circulating in spring and summer, its character and distribution, as seen by the even or uneven growth of leaves and new wood, determines how far a tree may be thinned and stopped.

In every orchard of size, trees of various form, age, and condition exist, and no uniform way of pruning at any season may be adopted. Nor should pruning be carried out during one particular month, but always according to the year, and the individual capacity and demands of each tree. Irrespective of species or variety, where branches are far apart, little or no thinning of the leaves and young wood is necessary in summer, as over-exposure tends to burn both foliage and bark, devitalize the sap, dwarf and injure the quality of the fruit, and shorten the profitable life of the tree. Summer pruning is, therefore, most beneficial when carried out on strong trees, which have their main and secondary branches excessively crowded, and which provide insufficient light and air in motion to secure proper leaf development and ripening of the leaf-yielding wood.

Wherever trees of any kind are old and hard of bark, growing in exposed and hungry soils, or stagnant from any other cause, their leaves should not be reduced in number during the summer season. Summer pruning is helpful and most necessary to the young and the strong, since in the young it takes away such surplus growth as would interfere with the desired form, and encourages growth to fill up parts which might otherwise remain bare and profitless.

It is possible to prune trees in winter only, and secure an even distribution of foliage and fruit, but it is invariably much more economical and sure to prune at both seasons, since the tree can be kept under control more by frequent than by infrequent handling. Further, summer pruning prevents labour of hand, and waste of energy on the part of the tree, whilst winter work invariably increases labour of hand, and adds to the unfruitfulness of the tree, that is, if not supported by summer work.

Summer work on trees may be carried out from the time leaves push out until they show sign of maturity in early autumn. Between these periods all the new wood of the year will be made. Fruit is borne on new or comparatively new wood only, and the size, chemical nature, and general health of the leaf determine the nature of the bud it will furnish. To keep trees growing, new leaves must be constantly unfolding, as wood does not extend after a leaf reaches maturity, so that where we desire to extend the size and vigour of young trees, they should not, as they would, be checked by summer pruning. Only in early spring and summer is it necessary to deal with young trees—rubbing off any buds which unfold in bad positions, as on the stem, or below where the main branches are desired, and a little later taking out the point of any extra strong shoot, so as to insure an equal growth to its neighbours.

To persistently pinch and stop young trees in summer shows complete ignorance of their wants, and must ever prove a misfortune to their owners.

The more leaves a plant can make and maintain, the more it will grow, and growth is all that is desired of the young and undeveloped tree. In a general way, young trees require hard winter pruning, and a little spring and early summer work in the way of thinning and stopping up to their third year. After this, if decidedly strong, they will require less cutting in winter, and this chiefly in the direction of spacing the branches to provide for the lighter fruit-yielding wood, and in spring and early summer such thinning as will provide space and full development of the requisite light wood. On the other hand, where a tree is weak, little or no spring or summer work is done, since every leaf is wanted to help on the circulation of the sap, without which the tree cannot survive long.

As trees come near to the bearing size, they demand more careful and frequent treatment in summer. An even crop of well formed, perfectly, and well-ripened leaves is required of all trees before they can yield even and good quality crops of leaves.

SAP MOVEMENT.

No one can for a moment presume to deal with trees in an exact way, who does not know the ordinary and extraordinary movements and variations of the sap. And this knowledge is particularly necessary when we come to summer pruning. In fact, trees should be pruned only in winter (if at all) where one's knowledge of their nature is decidedly limited.

When we cut or pinch a shoot very lightly in summer, it receives but a temporary check, and a bud from or near the leading leaf quickly pushes out and continues the lead. In such circumstances the inner nature of the shoot and the leaves it carries undergo but little change. Cut or pinch a little harder and the sap may stagnate, or force a strong new shoot, all depending on the period of summer, and the amount of moisture in the soil and the atmosphere. If dry and hot, feeble and fruitful growth will result from the hard cutting; if moist, "growing" weather, then the new growth

will be coarse, green, and impotent. In brief, if it were possible to cut or pinch to a certain length a shoot every day over three months of summer, it would yield different results from each daily operation; or, again, if we took a shoot 2 feet in length, and gradually reduced to within 1 or 2 inches of its base, it would, as a result of this varied treatment, produce equally varied results. Now, of course, these statements, are made only with the object of making the orchardist think before operating. It is pleasurable to know things, especially when they are the facts of nature, and it is only in so far as one knows how sap changes in volume and quality at different seasons and positions in trees that he may be said to possess a safe working knowledge.

The Size and Varying Function of Leaves.

No shoot or spur has leaves of equal age, nature and opportunity. Those at the base of the shoot or spur are the oldest and the weakest; those at the extreme point of a shoot seldom develop to the extent that they yield true flower-forming sap, and this is why so few shoots bear fruit or fruit buds.

The leaves which unfold during early and midsummer are the most complete and capable; they are formed out of more or less elaborated sap, and have the advantage of a dry and powerful heat; hence the buds they yield are more capable of yielding flowers than are those formed at any other period of summer.

Leaves should be studied both individually and collectively as they exist on any tree, in order that the proper check may be given, and change effected in the subsequent growth.

The Divisions of the Work.

To get the best average results, summer pruning should be practised at three periods. In spring and early summer to sweep away any excessive buds or shoots, which would, if allowed to stand, choke the desired leaves and the buds expected of them. Later on—in December or January—according to season, region and vigour of tree, more thinning will be beneficial, and also the stopping of stray shoots, or, in the case of the apple, converting shoots into spurs, since this check during the hottest period of the year invariably suspends the circulation of the sap, changes it chemically, puts additional pressure on the light wood which has been left, and thereby forces a weak new growth, which, more ripe in nature than the earlier growth, forms flower buds where dormant or active wood buds would otherwise appear.

Where spurs are made, a leaf or two must always remain at their ends, otherwise they will die through the sap having no power of rising to a leafless and budless point.

Towards autumn, normally in March and April, healthy bearing trees make more growth, which, if allowed to stand, overwhelms the leaves and buds made earlier in the year.

Late summer growth should, therefore, be removed outright from all mature trees, as its presence works injury in many ways. In the first place, the early or main crop of leaves must have room to ripen themselves and the wood whence they spring. Next, the late growth, if allowed to stand, adulterates, weakens, or overlays the original deposit of sap, so that flower

buds are less liable to become perfect and develop fruit; and, further, the action of the root is disturbed to the extent that it has less power of supplying the class of sap to which fruit buds look for sustenance and support.

Light and Fruit Bearing.

When the outsides of trees fail to carry fruit, it is usually because the wood has not had time to thoroughly mature, and thereby secrete the sap, out of which the flower buds and fruit are made; thus there may be an abundance of light, and yet no possibility of fruit on really young wood. But on the inside of trees the light is rarely sufficient to develop perfect leaves, and unless perfectly formed and well ripened leaves are secured, fruiting must be limited to the best lighted and most mature of the young wood. Remember that the good leaves in one part of a tree have no power to improve the quality of those in another part. All leaves are liable to rob each other by shutting out either light or air, but they can never pass on ripe sap or such elements as may be wanted by those struggling to exist in deep shade. Each piece of wood must, therefore, be given direct access to light and air in motion. The fruitgrower should always bear in mind that he is at one and the same time dealing with at least two crops. He has the fruit on the tree, which must be well developed by means of healthy leaves; and he has also to consider that the number, size, substance, and degree of ripeness in these leaves determine the nature of next year's fruit crop. Leaves must be abundant and strong enough to pull up plenty of sap, with which to feed the present crop, but not so strong and crude in character, or so densely packed, that they cannot ripen and provide the desired class of buds for next year. Midsummer is the time to thin such trees as apples and pears, which are in bearing; the stronger and more dense the foliage the more it should be thinned. Before one can thin with safety he must be able to judge if a tree is really strong or otherwise. All free growing trees are not over strong, and to thin such as are at all sensitive may work serious injury, but to those who can form a right estimate of the vitality and wants of different trees, there can be no better time than the early half of December for letting in a broken light to all parts of the head.

Young Trees to be dealt with in Spring Only.

The object of summer work on young trees is mainly to direct growth where it is wanted, and to take away such growth as would spoil the desired form.

Trees from one to four years should never be touched after November as the more leaves they carry the stronger they will grow, and with a good root and trunk system, it is easy and safe to cut the head into shape by winter pruning.

Not until a tree is distinctly large and strong enough to bear fruit, should it have its leaves reduced by either pinching or thinning in midsummer.

The Economy of Summer Work.

This is indisputable. It is cheaper in the matter of labour. It produces more certain and profitable results. Its effects are more lasting, in that a tree which is once or twice summer-pruned with intelligence, can be made to fruit over a great number of years, at little or no expense in the way of winter pruning.

Soil lasts longer owing to growth being less rampant. Fruit is more uniform in size, colour, and quality. Summer pruned trees produce the hardest and best keeping fruit.

Against summer pruning it must be said, that in damp and screened positions, black spot and other leaf diseases are liable to increase, since the second crop of young leaves may fall an easy prey to fungi. Woolly aphis also attacks all wounds in soft wood, as they occur in summer, so that it is necessary to spray and otherwise cleanse trees thoroughly whenever these pests are liable to occur.

THE REGION AND SEASON AS THEY AFFECT SUMMER WORK.

After a long dry summer, or loss of foliage and vitality, produced by over-cropping, storms or pests of any kind, trees require to increase their root range, and this they are unable to do if their foliage is seriously reduced in the summer following the strain. So it follows that where the soil is consistently and persistently favourable to root growth, summer pruning will be much more necessary than where, from excessive heat and drought, root growth is irregular, and always limited to a few months of each year. The capable orchardist will at once observe that summer thinning and stopping must always be in agreement with the natural or desired vigour of the roots.

In some positions summer work may be done with the sole object of steadying the roots and preventing the growth of crowding wood, whilst in others it may be necessary to save wood already made, air and direct sunlight being more or less necessary to all leaves when they are called upon to yield flower buds, or perfect fruit.

SUMMER PRUNING FOR FRUIT.

December is on the whole the best time of the year to commence thinning and shortening the shoots of apples and pears which are not supplied with a sufficient quantity of bearing spurs. The warmer the climate the shorter the period required to make and ripen fruitful wood, and as no two kinds of tree, nor any two seasons are exactly the same, it follows that no absolute time can be named nor amount of thinning decided upon to serve all trees, districts, or seasons.

Pears take longer to form and ripen wood than do apples, and again some apples may respond admirably to summer pruning, while others, especially if weak, would be injured by the practice.

To insure success in the work, first see that the tree has more leaves in some parts than it can bring to perfection, or that wads and masses may be screening other parts, and thereby run bare. Thinning alone may be sufficient for some trees, whilst others, after they have been thinned, should have some of the shoots cut back to two or more leaves, according to their strength and the opportunity existing in the way of space. The stronger the tree the further apart its leaves should be arranged, so as to allow a fair amount of sunlight to play upon the heavy wood. All spurs must be given two or more leaves, otherwise they are liable to die through the leafless stump having little or no power to draw up sap and furnish new growth.

On the whole, thinning and stopping are best for apples, but pears make spurs freely after being well thinned towards the end of December and throughout January. In very strong trees the weakest, or at least, moderately weak and spreading shoots or spurs, should be striven for, whilst trees of weaker growth need stouter and more upright wood to insure free fruiting. Once a tree has borne fruit it is an easy matter to discover what type of wood has borne most freely, and this seen, summer work is easy and sure, always providing that the resources of the season and general condition of the tree can be accurately estimated.

Summer Work on Apricot Trees.

Apricot wood takes a long time to ripen, and, excepting in the warmer districts, it is unwise to do any stopping or converting shoots into spurs during summer. Excellent results invariably follow hand thinning, or what may be called disbudding, of apricots during early spring. This work should be taken in hand before the young shoots toughen, as then they break away easily, and cause no serious wounds or loss of energy, whilst more room is afforded for the desired shoots and spurs. To thin or in any way reduce the foliage during the growing of the crop is to reduce its size and value, and so further thinning has to be left till the end of December and through January. As we have said, cutting back is inadvisable, for even though it leads to a second growth which will yield fruit in the hot north, it is at the expense of a great deal of bare space in the lower part of the tree, besides which its general vitality and length of profitable life is considerably reduced. Midsummer work on apricots should therefore be limited to thinning out the crowded tops, and also such inside growth as prevents the ripening of such leaves and wood as are expected to yield fruit in the near future.

The Mode of Thinning.

Since it is ever desirable to make each tree bear throughout its entire head, it follows that checks as by thinning of shoots and leaves should take place at such points and seasons as will force new growth on any bare parts low down and inside the tree. The leading shoots and wads formed at elbows or sharp curves of branches are therefore the points at which one reduces the activity of the sap.

What is superfluous should be taken away altogether. It is a silly and costly method that of snapping and leaving shoots, no matter what is expected of them, for they cannot fail to produce injurious shade and temporary loss to certain parts, besides which they encourage insects and disease, and put the owner to the expense of cutting them away in winter. When a man breaks a branch and leaves it, he at once admits his ignorance of the wood he is dealing with. To be sure it may come into fruit, but that is nothing if it can be made to do so by cheaper, cleaner, and safer means.

But we are here dealing with thinning, and its objects are to provide leaves where none exist, to give more light and air to those existing, to direct and control the size, shape, and substance of the various parts of the tree as a whole, to give as far as possible a set space and character to the sap, since we have it in our power to alter sap so that it will in autumn provide wood or fruit buds as we may desire

The various sizes of shoots, their position in the tree, and the age and character of the wood whence they spring, determine their inner nature, and what they can in time furnish; as other wood, or flower, and fruit. Thus in cool and shady soils and positions, trees are inclined to grow more wood than is necessary, and flower and fruit but shyly, or, perhaps, show a great deal of impotent or imperfect flower. This may arise from excessive crudeness of the sap.

Light on the leaves may bring about a free setting, but usually such a soil must itself receive additional light and air; and so when we come to thin trees, we must not think of the head or even the offending shoots alone. We need to know all the materials and influences which have gone to make the tree before we can rightly determine how, when, and where to thin its foliage, or in any way reduce its vigour.

Thinning Strong Trees.

All strong apples and pears, which are carrying tufts of wood, where no more than a single shoot is necessary, should be thinned in December. With the hand, break or pinch away the excessive shoots, leaving some with a leafy spur when they are seen to be desirable. In vigorous trees, the most important work is in their tops, thinning the extremities of each leading branch, so as to make the sap burst into growth lower down, and thereby furnish all the body of the tree with light fruiting wood. Do not pinch or in any way thin weak trees, as they need all the leaves they possess, even though these may be in faulty positions. Weak trees need hard cutting in winter, whereas strong and unfruitful trees are made profitable by judicious thinning and stopping in summer. Trees which are thinned in early spring will not call for further attention till the middle or end of January, after which time it is unsafe to promote spur growth, as insufficient time is left for its ripening before the fall.

The Mode of Stopping.

Stopping is the term applied to pinching or cutting back such shoots as are desired, though not in their entirety, and for these reasons:—As long shoots there may be insufficient room for their proper leaf development; they would create shade and barrenness, and, further, in some sorts of trees they would not, as shoots, promptly yield fruit; so for some one or more of these reasons they are cut or pinched back. This stopping causes more or less stagnation of the sap, the heated atmosphere withdraws the watery properties, the sap therefore changes, and what we term ripens rapidly. From this more or less ripened sap new leaves come forth, they cannot develop into coarse wood-forming leaves since it is midsummer time and moisture is scarce, hence they grow slowly, and gather the flower-bud making properties from all they imbibe from atmosphere and soil.

Whilst it is easy to explain the natural process of bud formation for any purpose, it is difficult to convey an idea of the extremely varied results which come from miscalculating the powers of leaves and trees, and the influences at work in different periods of summer.

Thus if two pieces of wood of exactly the same age, size, and general appearance are growing one at the top and one at the bottom, or one on the sunlit outside, and the other on the sunless and airless inside of the tree, and these two pieces of wood are pruned or stopped in the same

way, and at the same time, the growth which results from them will be in every way different both in appearance and value. And this, because a healthy tree is in no sense like a healthy animal equally vital and capable in all its parts. The selection of wood is, therefore, of the first importance.

In an extra strong tree, the weakest wood is likely to be most capable of fruit-bearing, whilst in a weak tree the stoutest of the season's shoots may not be too strong to yield fruit. Then the well-placed and most upright will be the strongest and most woody where the lateral and dependent shoots will be smallest and yet ripest, always providing they have developed in plenty of sunlight and air in motion.

Taking any full-grown tree, as an apple or pear, it may be necessary to stop shoots at every possible length between two inches and two feet; thus some will be converted into "spurs," whilst other shoots will be no more than tipped. And the reasons for this varied treatment? They are as vast as the number of shoots to be dealt with. Each is an individual quantity occupying a unique position, and calls for peculiar treatment if we are to at once make it yield fruit and fix its task.

Time involved in the Formation, Growing, and Ripening of Wood of Different Species and Varieties.

Seasons, soils, situations, and vigour of trees alter so much as to render it impossible to state an exact time as necessary to the growth and perfecting of a piece of fruiting wood.

Thus a strong tree, in a favorable season, may make useful wood in half the time which would be employed by a weak tree, or a "slow" season.

Since we desire "ripe" wood only for fruit bearing, midsummer pruning is the most favorable to its production—December to end of January in Victoria—but in cooler parts it may be done as early as November, whilst in hotter regions it may be practised as late as the end of February (peaches only).

Of all fruits the peach forms and ripens its bearing wood in the shortest time—In really hot regions in from nine to twelve weeks; in average Victorian conditions in from eleven to fourteen weeks; in cooler regions from fourteen to eighteen weeks. Knowing the ordinary period of "fall," and observing the vigour of the trees together with the behaviour of the season, furnishes a clue as to the time when the trees should be thinned and stopped in order to secure fruiting wood. This, of course, applies to all trees.

Apricots in hot regions endure stopping immediately after the fruit is taken, but in a general way it pays best to limit summer work to thinning during December and January.

Pears and apples are the two fruits which pay best for systematic thinning and stopping in summer, but as their vigour and condition vary, so must the treatment. Trees bearing freely should be very lightly pruned or left alone.

Some pears make fruitful wood in a short period, but as a rule they require from eighteen to twenty-four weeks to form a perfect wood. Therefore stopping (which, of course, promotes new growth), should not be done after December, whilst in cool regions November is quite late enough to do the work.

Thinning may, with advantage, be done whenever leaves are seen to be crowded, as light is a constant necessity where flowering wood is sought.

Once a tree has borne fruit, its bearing type of wood is easily seen, and, of course, any summer work should be done on wood which will secure the development of wood of the right size. (If fruit is borne on wood of different sizes and qualities, it also will vary, and it is from failure to observe this rule that so much irregular fruit appears.)

Apples average a slightly shorter time than pears, thus they make useful wood in from twelve to twenty weeks. Of course, the better the position, the shorter the time involved in ripening wood.

In cutting wood of different sizes and angles of growth, different lengths and numbers of leaves must be given. Thus an upright piece of wood, in a central position, can draw up more sap, and make stronger growth with two or three leaves than can a shoot carrying six or eight leaves in a side or horizontal position.

Again, shoots or spurs formed at the base of branches need to be of two or three times the substance of those selected at the top or leading points of the tree.

Short-jointed and firm, well-coloured shoots should always be selected for treatment, and such as are "drawn" have usually small and thin pale leaves, which should not be pinched back, but left alone or removed outright, if they are superfluous.

Where summer pruning is taken in hand, notes should be made of all the varieties dealt with, and the seasons at which they are treated. The following winter will reveal the results, and thereby give a fair idea of the seasonable requirements of each kind.

CLOSER SETTLEMENT STUDIES.

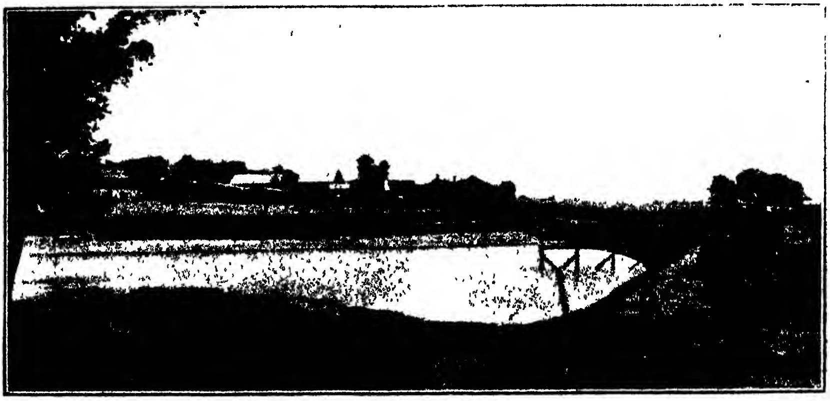
AROUND THE GOLD-FIELDS, No. 1.

A. S. Kenyon, C.E.

The land around our gold-fields was rarely available for settlement under the ordinary conditions of selection, and consequently is held, if at all, in small areas. Speaking generally, its quality is of the poorest, and for the most part there is almost an entire absence of surface soil. Clay closely resting upon the silurian—or rather in more modern terminology, the lower Ordovician—slates and sandstones, and containing much shingle and angular quartz gravel is the rule. Nor does the natural vegetation appear more inviting—Eucalyptus saplings and suckers, scrubby black wattle, broom brush, and other shrubs, with some scanty and inferior grass form the general surroundings of our reefing fields. Yet amongst them numerous examples of what labour and intelligence can do with small areas of inferior land are readily found. Needless to say that, with the conditions given, irrigation is almost always the principal factor in success.

At Stawell, just behind Big Hill, is a small farm where irrigation from gully dams has been practised for a quarter of a century. Dams of considerable capacity—one of three, another of one million gallons, as well as a smaller one—have been constructed on a gully running down

from the Big Hill through the property. Outlets in the bank at different levels are made with piping, and from them a complete system of small



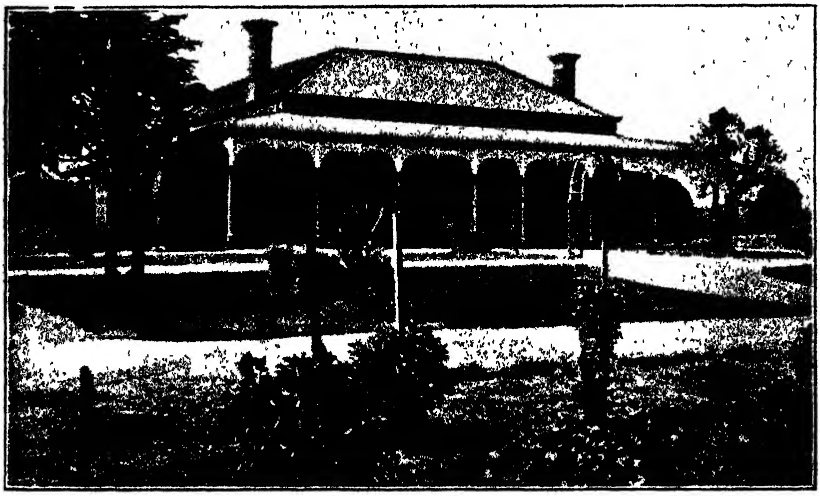
GULLY DAM.

channels irrigates the pastures. The chief source of revenue was milk sold on the farm, though in times of drought, before the installation of a reticulation in the township, a considerable profit was made from the sale of water itself. Since the death, a short time ago, of the original owner, the farm has not been worked to the same extent. The profits resulting from the factors, water conservation and dairying, may be judged from

TWO OF THE MILKERS.

the photograph of the residence on the farm. Just below, Mr. Sargentson and his son hold 6 acres under garden licence. Inspired by his neighbour's example, Mr. Sargentson—an old miner whom the local depression in mining had thrown out of employment—built a dam a few hundred yards above his land. Some 4 acres are laid down in strawberries, tomatoes, and general vegetables. The dam is much too small for requirements, and Mr. Sargentson intends constructing another of much

greater capacity. Yet, with the present one, capable of putting only some 3 inches in depth of water at the outside over the ground, a very fair living is made, while the certainty of even greater returns has been acquired. Even after a most exceptionally dry season, and at such a late period as February, strawberries still were on the plants, and the generally flourishing appearance of the garden was a striking contrast to the uninviting country around. Where a goat of the most enterprising character would have failed to secure its living, man can make enough profit to maintain a family. Mr. Sargentson also crops some 10 acres of oats, and has some fruit trees in an adjoining freehold of 40 acres. These are not irrigated, and the profit from them is very small. In another part of



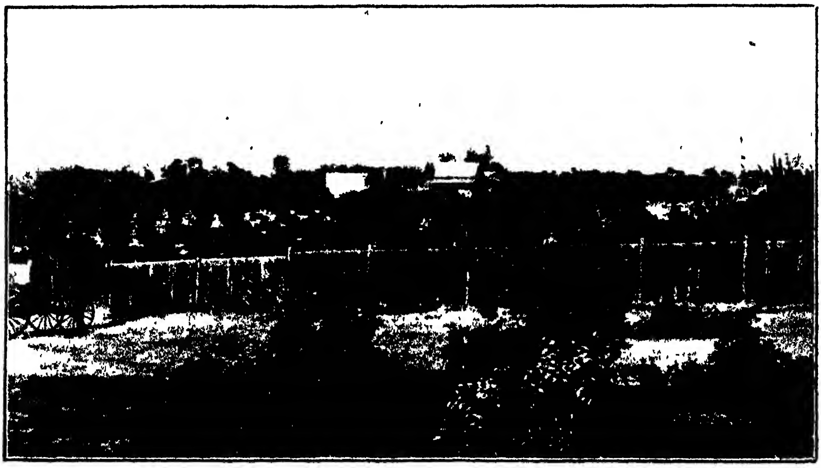
THE HOMESTEAD.

the town, close to the railway station, and surrounded by dwellings, an acre of tomatoes has been cultivated with remarkable results. Water is obtained from the mains at a cost of one shilling per thousand gallons, and as much as £15 per annum is paid for it. This sounds high, but the total depth of watering would be not much over 14 inches; off this acre, some 20 tons of fruit are produced annually. The soil has been to a large extent made artificially. Soil from gullies, refuse from wood heaps and from similar sources have been called into service. Large quantities of stable manure, blood manure, and bonedust are used. The system of culture adopted is principally staking with some trellising. The rows are 4 feet apart, and the plants 3 feet apart in the rows. Planting is done in October, no special effort being made to get early results. Boys are employed occasionally to stake and tie up, and pick the fruit. A fair proportion is made into sauce when prices are low. On some parts of the block, tomatoes have been continuously grown for eighteen years without any evidence of exhaustion. It is clear that the manures used supply the various constituents removed by the plant.

At Bendigo, Mr. Cumming's Flora Hill dairy farm has been already described in the Journal.* Within sight of it, there are numerous

* Closer Settlement Studies, No. 1, Dr. Cherry, p. 111, March, 1905.

examples of intense culture—not all long established, many being of very recent date. On Solomon's Hill, just below the Solomon's Gully reservoir and race, is a 10-acre orchard belonging to Sir John Quick, and managed by Mr. A. W. Potter. There are two blocks, one of 7 and one of 3 acres, separated by a road. On the 3-acre block there are planted one and a-half acres of pears, and nearly the same area of peaches. The land was broken up by contract; one half-acre trenched 2 feet deep and manured; the remainder ploughed 11 inches deep, all stones picked up, harrowed, and graded at a cost of £8 per acre. One hundred and eighty trees were planted to the acre. The trees have only been planted two years, and are, of course, not yet giving returns. Crops are, however, being gathered between the rows. Except for some asparagus, to be ready for cutting next season, the spaces between the pear trees are devoted to peas and tomatoes. Last season the peas gave a return of £11 per acre, and were ploughed in afterwards as green



SOLOMON'S HILL ORCHARD.

manure. Two hundredweight of Thomas' phosphate were used with the peas and two waterings were given. The season after peas have been grown, tomatoes are put in as a rotation crop. Tomatoes yield about 400 cases of 40 lbs. each per acre. An average price of about two shillings per case is obtained—a return of £40 per acre. Several varieties of peaches are grown, producing a continuous supply of ripe fruit throughout the season.

In the 7-acre block, there is quite a variety of apricots, peaches, plums, citrus, and vines. These last form the principal crop—some three acres—and are wholly table varieties. The citrus trees are not a success, and are to be taken out and replaced by pear trees. The apricots have not borne well, owing to late frosts, for two years; but in decent seasons yield about 150 hundredweight to the acre, bringing in about £40. From the vines about 120 cases to the acre are obtained, and sold for three shillings a case. The vines are planted in rows 12 feet apart, the distance apart in the row being 9 feet. They are ploughed in autumn, and again in the winter, while during summer some five scarifyings are given.

Manuring is done by peas as already described, by ploughing tares for the vines, but principally by stable manure obtained in Bendigo at sevenpence and upwards per load. Any soil or rubbish obtainable in the neighbourhood is carted in and put to use.

Waterings are given twice a year to the pears, and three times to the vines. In all about one million gallons per annum are used at a cost of a little over £4. As 9 acres are irrigated, the cost comes out well below 10s. per acre. The Solomon's Gully race runs just above the 7-acre block, and a small dam of 60,000 gallons' capacity is connected with it. From the dam a small pipe system affords water to a small plot of pumpkins and other vegetables. Races carry the water to the trees. The whole depth put on appears to be under 6 inches, and, as the water supplied is accurately gauged, it may be accepted as the actual volume required by the trees for healthy growth. At the Flora Hill farm, the water used was equivalent to a depth of 7 inches. Very little of the produce is sent to Melbourne, the local markets absorbing practically the whole.

Not far from here is Mr. Keck's orchard and nursery, covering, in all, some 40 acres. Mr. Keck has been very successful, and his orchard is one of the beauty spots of the locality. He also works his land hard, growing fodder crops, tomatoes, or cabbages between his trees. He gives three to six waterings per annum. After ploughing, a watering means a consumption of about 60,000 gallons per acre; but after scarifying 24,000 gallons only are required. No artificial fertilizers are put in, stable manure, carted from Bendigo at a total cost of 2s. 9d. to 3s. per ton, being used. Mr. Keck is of opinion that a good living can be made off 10 acres of the surrounding country, provided water is available, and that sufficient capital, say, £500, is at the settler's command. This might be much reduced by judicious growth of profitable crops, in the first few years, while waiting for the trees to get into full bearing. It must be borne in mind, however, that the orchardist, to be a success, cannot go in, to any extent, for other pursuits. Trees in their growth require constant personal attention and the continued presence of the grower is a *sine quâ non.*

IN THE MYRTLEFORD DISTRICT.

J. Mathieson, District Inspector of Stock.

The part of the valley of the Ovens River above Myrtleford is usually considered more adapted for mining than for agricultural purposes, and during the last few years some of the best parts of the flats on the frontage have been converted by dredging into immense gravel beds, and rendered absolutely useless for either grazing or cultivation. That some of this land is very valuable may be proved by a visit to the farm now occupied by Messrs. F. Muller and Sons. It is near Ovens Vale, and consists of 270 acres, mostly rich river flats. From what was, a few years ago, practically virgin country, very satisfactory results have been obtained by intense culture, and rotation of crops.

The land under cultivation (not including the garden), comprises 65 acres of oats (cut for hay), 50 acres of potatoes, 20 acres of maize, 8 acres of peas, and about 3 acres of pumpkins. The maize looks very promising, and a good crop is expected. The peas yielded 35 bushels, and 20 acres of potatoes

(early crop), 4½ tons to the acre, while from the late crop of 30 acres, it is expected to bag fully 6 tons per acre. This season some of the early

PUMPKIN FIELD WITH MAIZE PLANTED IN DRILLS FOR SHADE.

potatoes realized £4 per ton, and £7 per ton is now being received. Last season 30 acres yielded 7 tons per acre, and brought £5 per ton. Gross

"CANADIAN WONDER" BEAN PLANTATION.

value, £1,050. The potato seed ("Vermont" and "Up to Date") are sown with a planter, about 3 cwt. of prepared manure being applied at the same time.

Just now the vegetable garden (about 9 acres) is well worth a visit. Here there are 2½ acres of onions, 2 of cabbage, and 1 of tomatoes, besides a great quantity of melons, French beans, carrots, &c., all well grown, and in excellent condition. Consignments are being sent away almost

every day, mostly to towns in the north-east, such as Bright, Wangaratta, Rutherglen, &c.

The estimated yield from 2½ acres of onions is about 19 tons, and from 1 acre tomatoes 20 tons, besides a splendid crop of cabbage, beans, &c. As soon as one crop is used up, it is replaced by another, so that the gross annual income from this valuable piece of land will be very considerable.

The garden is situated in a very pretty bend of the Ovens, that a short time ago was covered with dense scrub, the cost of clearing being about £8 per acre. This, however, is labour well rewarded.

ONION FIELD.

Besides the potato planter and the usual supply of ordinary farm machinery, a four-horse portable engine is used to work a 5-inch centrifugal pump for irrigation purposes. The plant is transferred from place to place as required. The stock on the property includes 10 horses, 6 cows, 40 pigs, and at the present time about 250 sheep. The place is altogether a striking illustration of what may be done on a good farm well worked.

MILK AND DAIRY SUPERVISION ACT 1905.

The following statement with regard to the *Milk and Dairy Supervision Act* is published for general information:—

1. The Act comes into force on 1st July so far as the Metropolitan, Ballarat, Bendigo and Geelong milk areas are concerned. Every farm, wherever situated, which supplies milk for direct human consumption to any part of these areas is included in the corresponding milk area, and comes under the Act.

2. The Act may be extended to any municipal district outside a milk area by the Governor in Council, either at the request of the Municipal Council or without such request. In the former case only the Act is administered by the Council, and several Councils may join together and appoint one supervisor.

3. The Act will be brought into force as early as possible in those municipal districts which have requested to be allowed to administer the Act.

4. In the case of municipalities who do not wish to undertake the administration of the Act themselves, it is the intention of the Department gradually to extend the operation of the Act as fully qualified supervisors are available. In the meantime such municipalities may continue their system of dairy inspection under the provisions of the Health Act. [*In all cases in which it is proposed to extend the operation of the Act to the whole or part of a municipality, three* (3) *months' notice of such intention will be given to the Municipal Council.*]

5. The annual licence fees to be fixed by regulation of the Governor in Council will be as follow:-

For every dairy farm	6d. per cow.		
For a butter factory	£2	0	0
For each creamery	0	5	0
For a dairy (that is, the premises of a milk vendor where milk is kept for sale)—			
(*a*) Where the milk is sold only over the counter ..	0	5	0
(*b*) Where one to four milk carts are employed	1	0	0
(*c*) Where more than four milk carts are employed ...	2	0	0

(Where a farmer retails the milk direct from his farm no extra fee will be charged beyond that which he pays for his farm. Where a farmer owns also a depôt in the town this will require to be licensed as a separate dairy).

SUPERVISORS.

6. All supervisors, whether appointed by the Department or by a Municipal Council, are required to pass a written and practical examination. Supervisors are appointed for one year only, on the conditions set out below. In case the Department renews the engagement of a supervisor for another year, an increment of £25 will be allowed, conditional on the supervisor having shown *progressive* efficiency during the previous year's work. At least fifteen supervisors will be required to undertake the work of those municipal districts in which the Act comes into operation on the 1st July. Departmental supervisors will be paid an allowance for horse or bicycle, and travelling allowances when engaged in the country.

7. The following section is quoted from the *Milk and Dairy Supervision Act*:—"The supervisors shall not be subject to the Public Service Acts. Each supervisor shall be appointed under a specific contract with him for one year, but shall be eligible for re-appointment from time to time, and he may be at any time removed by the Governor in Council. Shall satisfy the authority that he has had sufficient *bonâ fide* practical experience in dairy farming and its allied branches of agriculture and amongst animals. Shall be selected after a written and practical examination by examiner appointed by the Governor in Council. In such examination special importance shall be attached to the practical part. In lieu of the written part of the examination, the Governor in Council may accept any prescribed public examination. Shall be paid a salary at the rate of not less than £150 per annum, and shall have a district assigned to him annually.

It shall be the duty of each supervisor to become personally acquainted as far as possible with every owner of a dairy farm, dairy, or factory,

and the conditions of every dairy farm, dairy, and factory in his district; to confer with or advise such owner on matters connected with his farm, animals, premises, utensils, milk, and dairy produce when requested to do so, or when instructed to do so by the authority; to inspect and examine all premises, utensils, and appurtenances, and also all animals and their food and water supply, and also all dairy produce at such dairy farm, dairy, or factory, in such manner and by such means as may be prescribed; to make such other inspection, examination, inquiry, or investigation as may from time to time be directed by the authority; and to report to the authority the results of inspections in such form as the authority may require, or as may be prescribed." •

Examination for Supervisors.

The examination for dairy supervisors will include written, oral, and practical tests, and will require of candidates a knowledge of—

Dairy Practice, including (*a*) stock management, the breeding, rearing, feeding, and management of dairy cattle; the composition and value of the most important foods or food stuffs; the factors which influence the yield of milk. (*b*) Dairy farm management, including the preparation and cultivation of the land, and the subsequent handling and preservation of the crops, pasture, water supply. (*c*) Milk and dairy produce, their characters, production, examination, preparation, and manufacture, methods of handling and transit; dairy utensils and appliances.

Dairy Sanitation.—(*a*) The arrangement and construction of buildings and yards; (*b*) disposal of drainage and manure; (*c*) methods of cleansing and disinfection.

Stock Ailments.—(*a*) A sound knowledge of the notifiable diseases under the Act including (*a*) symptoms and diagnosis; (*b*) methods of isolation; and (*c*) quarantine and disease prevention.

Candidates with approved veterinary qualifications for appointment as supervisors in milk areas will require to show full and practical knowledge in detail of the anatomy, physiology, and dietetics of farm animals.

Evidence of ability to verbally expound details and facts concerning the above subjects, and to carry on inspectorial duties in a tactful and educational manner, will receive a special recognition in the examination.

The written examination will be held on 4th May, and the practical examination will be held early in the following week. Entrance forms may be obtained on application to the Secretary, Department of Agriculture.

No special text-books are prescribed, but candidates may consult the following with profit:—

Bailey—*Principles of Agriculture.*
Wing—*Milk and its Products.*
Year-Book of Agriculture for 1905.

Seeing that the examination on stock ailments will only cover notifiable diseases, there is no book which deals with these alone in concise form. Standard modern works which may be consulted for these diseases are Law, *Vet. Medicine.* Vol. IV., or Bollar, *Diseases of Cattle.*

The following are set out as model questions and answers in order to give an indication of the style and scope of knowledge required at the examination:—

1. Mention ways in which cowshed, floor, and surrounding ground surface may be kept free from offensive and stagnant animal fluids.

Answer—Assuming that the floor is in good repair, and has an even and watertight surface, a gutter at the rear of the stalls graded with a fall of

1 inch in 10 or 20 feet will serve to carry off the animal fluids. These might be caught in a suitable catch-pit at the end of gutter outside the shed. This receptacle for drainage should be emptied on to the manure heap or on to cultivated ground at a distance every second day, or at all events before it has begun to decompose or give off offensive odours. Another effective plan is to spread a shovelful of dry earth in the gutter at the rear of each cow each time they are milked. The dry earth absorbs the urine, and may be removed along with the dung, so increasing the amount of rich manure compost.

2. On what evidence, both of information and observation, would you suspect the existence of pleuro-pneumonia in a herd?

Answer—Some such contagious disease as pleuro-pneumonia might be suspected in the event of more than one or two cattle having died or suffered severely from an illness of from one to three weeks' duration, especially so if the deaths occurred amongst cattle that had been recently introduced from an unknown source. The suspicion would be strengthened if on inspection and examination of an affected animal it was found to have a combination of some of the following symptoms:—Standing away from the rest of the herd with staring coat, back arched, head extended, and breathing heavily; groaning or subdued grunting at intervals; a cough on being bustled about; rise of temperature to 104 deg. F. or 105 deg. F.; pain exhibited on pressure with the thumb between the ribs.

3. What would you advise a farmer at Preston to do in order to secure a good crop of maize for green fodder next summer (no irrigation being available)?

Answer.—(i.) To secure a good crop of maize it is necessary to provide a good seed bed, and to conserve the soil moisture. Plough the land, and if possible, subsoil it early in the coming winter.

(ii.) Disc harrow it, or use other implement to reduce it to a fine condition whenever it is dry enough to carry the horses.

(iii.) Re-plough about the middle of October.

(iv.) Harrow and plant in drills 3 feet apart, using 1 cwt. of superphosphate to the acre, say about the end of October. If no drill is available, open a shallow furrow, and dribble in the seed and manure by hand. Half a bushel of seed to the acre is enough. Then harrow and roll.

(v.) Harrow again as soon as the plants are well up, or begin to use the cultivator between the rows. Continue to do so as soon as the surface is dry after every shower of rain, or every three weeks if no rain falls. Cultivate about 2 inches deep.

N.B.—The success of the maize crop will largely depend on the amount of farm-yard manure that is available.

4. Give the reasons why you object to little bits of cow-dung falling in the pail while milking.

Answer.—Every kind of dirt of animal origin contains immense numbers of living particles, which are able to live in the milk, and also to multiply very rapidly in it. As they multiply they set up the changes known as fermentation and putrefaction. After a time the milk goes sour and becomes curdled. These changes are objectionable, both in milk intended for direct consumption and in milk which goes through the separator. In the former case its value as an article of food is lessened, and it is very liable to cause digestive trouble, especially in children. In the case of milk used for butter or cheese, the cream will most likely not ripen properly, and the butter or cheese will have a bad flavour, and will not keep well. Moreover, dirty milk or cream quickly destroys the value of clean milk or cream when they are mixed together.

COLAC FLAX-GROWING COMPETITION.

J. Robilliard.

The Agricultural Society, Colac, this season offered three prizes for the best crops of flax grown in the district. There were ten entries, nine of which fulfilled the necessary conditions. The judging was done by points, as follow:—

	Points.
(*a*) Length of staple	30
(*b*) Seed yield	15
(*c*) Evenness of crop	15
(*d*) Preparation of seed bed	20
(*e*) Cleanliness, freedom from foreign matter ...	20
Total	100

The following are the points awarded:—

——	A.	B.	C.	D.	E.	Total.
R. Heppell	21	11	12	15	13	72
J. Inglis	22	10	12	15	11	70
Dr. J. Wynne ...	18	11	13	13	14	69
W. R. Edgar	19	10	10	13	10	62
— Fish	15	8	11	13	14	61
— Wylie	16	10	9	12	11	58
Jno. Wood	17	9	8	11	12	57
Messrs. Denis and Wettenhall .. .	15	8	10	12	11	56
— Parker	12	6	7	11	11	47

The crops are, on the whole, rather short, owing to having been put in late in the season, but this mistake can be avoided in future. Though short, the growth must be considered very satisfactory, when it is remembered the sowing was done between the middle of July and the end of August. The crops, too, generally are of uniform growth, and fairly well headed, though I am afraid the seed will in some instances be rather pinched on account of having been cut a little on the green side. Owing to the want of length, the yield of fibre will not be large, though the results obtained should be sufficiently encouraging to warrant larger areas being put in this coming season.

The Agricultural Department is having a complete set of flax-treating machinery made, with a view to giving demonstrations in flax dressing, and also for assisting growers who may not have a sufficiently large quantity of straw to warrant them in purchasing a plant. I would, therefore, suggest that application be made, in the usual manner, for the use of the thresher, or boll crusher, as the threshing should be done at an early date. It has been suggested that the machine be set in a central position for the purpose of treating the small lots in the neighbourhood.

Each grower would do well to ret the whole of his straw, even though it may be on the short side, as it will give him an insight into the work that will be of value to him should he decide on cultivating flax more extensively next season.

The Agricultural Society is to be commended for the steps taken in endeavouring to introduce flax-growing to the district, for the industry

should prove a very remunerative one. Though the crops recently grown are not all that can be desired, yet the experiment has proved, beyond a doubt, the suitability of the district for the production of flax for both seed and fibre purposes. I am pleased to note that several of the growers intend giving it another trial, and, profiting by past experience, will no doubt be more successful in future. To these and others who may desire to enter into its cultivation, I would like to point out:—

1st. The necessity of thoroughly pulverizing the soil to the full depth of ploughing, and working it up to a very fine tilth, as the crop will well repay a little extra work in this direction.

2nd. The necessity for early sowing. The time will, of course, differ with the various districts and conditions, but May or early June would probably be the most suitable in the Colac district. The object aimed at is to raise a fairly strong well-rooted plant before the cold weather sets in, to enable it to successfully tide over the winter.

3rd. The advantage of having clean ground. All weeds are more or less objectionable, but those such as thistles, wild mustard, dock, &c., are especially so, and if found in the crop, should be removed, for they not only take up ground that should be occupied by flax, but are troublesome in each of the subsequent operations.

4th. Flax should be cut as low as possible, for the fibre commences from just above the surface of the soil, so that each inch of stubble left lessens the yield.

5th It is advisable, when harvesting the crop, to make small sheaves, as they are more quickly and satisfactorily threshed. As this operation is accomplished without cutting the bands, it is somewhat difficult to crush the bolls in the middle of large sheaves.

GARDEN NOTES.

J. Cronin, Inspector Vegetation Diseases Acts.

The Phlox.

Phlox is a genus of hardy herbaceous and perennial species, with the exception of one annual kind (*Phlox Drummondii*). The native habitat of the whole genus is North America. The varieties grown in gardens are mainly herbaceous. They have been produced by cross-fertilizing certain of the species, and are worthy of more general cultivation and attention. They are a class of plants that are ornamental in any garden when well grown, and have been greatly improved during the past few years by culture and selection. The varieties once grown were mostly obtained from *Phlox decussata*, and although beautiful, were limited in range of colour, and rather tall in habit of growth. These varieties and the parent type, were inter-crossed with *Phlox suffruticosa*, from which also garden kinds were raised, the result being the production of a class dwarfish in habit, larger in the individual blooms and trusses, and much more varied in colour. Another advantage is the lengthened period of flowering. Some of the newer varieties bloom much earlier than the older kinds, while others do not flower till later It is possible to have phloxes in flower under favorable conditions for several months. Of the perennial evergreen kinds, few have been cultivated here. They are mostly

dwarf, creeping plants, useful for rockeries, for which use one species—*P. subulata var. Nelsonii*—is grown in the Melbourne Botanic Gardens. The annual species—*Phlox Drummondii*—is a native of Texas, the colour of the original being purple. English and European florists have produced from this annual a great number of varieties or forms. It has become one of the most popular plants grown, owing to its easy culture, hardiness, and range of colour, which embraces almost all shades except blue and bright yellow. One of the best strains is known as grandiflora; others, such as cuspidata (star flowered), and fimbriata (fringed), are pretty.

Phlox Drummondii, grandiflora.

Perennial Phlox "Coquillicot" red, and "Madame Domage," white with pink eye.

Any fair garden soil, deeply worked and moderately manured, will produce good plants that will bloom well. A cool friable loam is best. As the plants flower during the hottest and driest part of the year, a position sheltered from north winds should be chosen in the borders. A fair amount of water is necessary, and the plants will benefit by being mulched early. Most of the later types are from 1½ to 2½ feet in height, a fact which should be remembered when selecting positions for them. The plants should be allowed plenty of room, and not be disturbed for several years, except for propagation purposes. The usual method of increase is by division of the crowns in autumn and spring. Plants may be struck from cuttings of the young growths placed in pots of sandy soil in a cold frame. They may also be propagated from root cuttings. Seeds of the herbaceous kinds should be sown as soon as they are ripe. The plants will not appear until spring under cold treatment, but will flower during their first season. *Phlox Drummondii* is only produced from seeds, which should be sown at various times in spring—the earliest in August, and until the end of October. The seedlings should be transplanted when about 2 inches high. A few of the best herbaceous varieties are:—"Etna," "Coquillicot," and "Flambeau," red; "La Neige," "Jeanne D'Arc," and "Mdme. P. Carpentier," white: "Madame Domage" (an old variety), "Faust," and "Henri Martin," white, with coloured eye: and "Carillon," "Fluton," "Wm. Ramsey," "Gideon," and "Iris," rose and purple shades.

Flower Garden.

The present is a suitable time for planting hardy evergreen trees and shrubs that have been grown in pots. After rain, and while the ground is warm, the roots become active quickly, and before the soil becomes cold, make fair headway. The advantage gained is that the roots have a deeper and wider hold, and obtain nourishment over a greater area, enabling the plants to start into vigorous growth early in spring. The same advantage is gained by dividing and replanting crowns of herbaceous plants (that flower in spring and summer) at this period. Ornamental grasses should also be divided and planted now. A few clumps are very effective in mixed groups and borders, relieving the heaviness and flatness that is a common characteristic. In large borders pampas grass, bamboos, and eulalias produce the desired effect.

Chrysanthemums grown for large blooms are at their best from mid-April till mid-May. Liquid manure may be applied with advantage until the flowers are half-developed. After that time, no benefit is derived from such applications, but on the contrary, damping of the petals will be induced.

One of the most interesting phases of gardening is the raising of new varieties of flowers from seed. There is very little variation in most annuals, a number of which are species, though seed should be saved, if possible, from any specially good type that may occur; but in what are styled florists' flowers, such as chrysanthemums, dahlias, carnations, roses, &c., that have been largely inter-crossed, any one carefully saving seed from the best varieties may produce something superior to existing kinds. Dahlias from now on will produce flowers of less size and substance, many of which will show the centre, or disc, containing the pistils and stamens. To procure seed likely to produce good varieties, only one class should be allowed to bloom for a time. If the aim is to raise cactus dahlias, all the flowers should be cut that are open or opening. Then allow only those to flower that are of the finest types. It will be advisable to collect pollen during dry warm weather and fertilize the flowers, although dahlias are composites, and difficult to control. Good varieties may be raised from seed saved from flowers without hand fertilization, if good kinds only are blooming in the neighbourhood at the time. After the flowers selected are over, they should be marked, and the whole of the plants may be allowed to bloom as they will. The seed will be ripe in June, and should be cleaned and put away in a cool dry place till spring. Time, and manner of sowing, will be referred to in season.

Kitchen Garden.

Perennial herbs may be increased by dividing the old plants now; herbaceous vegetables, as rhubarb, globe artichokes, &c., require the same method of increase unless raised from seed. Rhubarb thrives best in a rich sandy soil, and existing varieties can only be perpetuated by division. Occasionally good seedlings are noted, but the proportion is small. "Topp's Winter" improved, "Early Albert," and "Myatts' Victoria," are popular varieties of rhubarb. Asparagus growths should be cut to the ground when ripe, and the beds cleaned and top-dressed with short manure.

Celery, cabbage, and cauliflower plants should be set out. Seed of broad beans, and early varieties of peas may be sown. The latter should be trained on a rough, temporary brush trellis. Sowing should be made according to requirements of onion, parsley, cabbage, lettuce, radish, and other seed.

AGRICULTURAL HIGH SCHOOLS.

(Reprinted from the "Year-Book of Agriculture.")

T. Cherry, M.D., M.S.

The response to the offer of the Department to establish Agricultural Classes, the interest which is everywhere being taken in the results of experimental work, and the advance which has taken place in educational methods generally, make it desirable to review the position with regard to the education of the farmer. The introduction of nature study and experimental science into the State schools has laid the foundation, while the establishing of a degree in Agriculture at the University has completed the superstructure. The present seems a fitting opportunity for considering what can be done to bring the advantages of a more thorough training within the reach of every one who obtains his living from the land.

What other Countries are doing.

While the final grades of agricultural education have been long provided for in Europe and America by colleges and chairs at the Universities, it is only of recent years that interest has really been awakened to the requirements of boys and girls after they leave the primary schools. It has been recognised that science lends a helping hand to agriculture through the medium of improved methods, and of recent discoveries, but educationalists have just awakened to the possibility of the great advantage to the majority of the children of farmers if their education can be carried on for one or two years after leaving the primary school. Everywhere there are complaints that population flocks into the city. The question is: Can anything be done to prevent this by moulding the character of the boys and girls so that they become enthusiasts for country life and for country pursuits? Among the earliest attempts to solve this problem are the "Farmers' Schools" of France, established in 1824. Under this system the boys were practically apprenticed to some of the leading farmers in an agricultural district, and learned the practical work of the farm in the same way as they would have done at any other trade. Little attempt was made to further their general education. On the other hand, reading lessons in agriculture were early introduced into the National schools of Ireland. In the case of France we have an example of practice without theory, and in the case of Ireland of theory without practice, and both have failed. Briefly, we may say that in recent years, it is everywhere recognised that theory and practice must go hand in hand—"that in each of the sciences bearing upon agriculture there are a few great principles which may without difficulty be mastered by a boy, and their application to agriculture may at the same time be fairly shown and verified by practical demonstration and by actual experiment. It is absurd to try to make the farmer a chemist, or botanist, or physiologist; but the laws of nature in soil, and plant, and animal are to be his friends or enemies throughout life, and it is essential, if he wishes them to be friends and servants, that he should understand their ways." In Denmark, we find that the practice most generally adopted is for the youths of both sexes, who have completed the primary course, to attend secondary schools for about six months every year. In these, science is taught to all pupils, but it is distinctly subordinate to the literary side of their education. Practice is obtained by working on their fathers' farms or on those of some of the neighbours for the other six months of the year. Indeed, the

sons of well-to-do farmers, who wish to become expert agriculturalists, hire themselves out to the best farmer in the neighbourhood, and do all the work in the same way as an ordinary labourer. Some such combination of practice and theory is thus obtained in most Scandinavian countries. Reliance is placed upon furthering the general education of the farmer by developing what is called a "cultivated common sense." The progress of the northern races depends upon the combination of this side of their character with sound agricultural practice.

With the development of manual training and other practical work in the primary schools of both England and America, the opinion is steadily gaining ground that the true solution of the problem of education for the farmers' sons is to be found in a combination of literary work, scientific study, and practical farming. Under the title of "A Plea for a Great Agricultural School," the following seem to be the conclusions of Mr. James Mortimer, head master of the Grammar School and County School of Agriculture, Ashburton, Devon. (1902):—

"I should not, however, advocate the above course of study unless it could be combined with actual manual labour. No study of an operation can be of much use, unless one takes part in it oneself. The farmer, whose training we are describing, must be more or less a worker, and his school life ought to afford him opportunities for the training of those muscles and the acquiring of that manual skill which he will have to use afterwards. This manual work should be of a very varied kind. In the carpenter's shop and smith's shop, under careful teachers, he might learn the use of the various tools in wood and iron work, and some knowledge of welding and soldering, which would undoubtedly be of service in his after life. Each boy, according to his age and strength, could have suitable work opportioned him in the byre or the dairy, and in fine weather in the garden or the field. Strong lads of fifteen or sixteen can be taught ploughing and harrowing, hedging and ditching, the management of machinery under supervision, some of the operations of the harvest-field, and many little tasks necessitated by the keeping of stock could be done by boys. In a school with a high tone, the most menial work could be made honorable; and that end could be attained which of all others is at the present time most to be desired for our English youth, the raising of manual labour to its true position as one of the essentially noble forms of human activity." (Page 643.)

. . . . .

"The main branches of the farmer's education then should be—

1. Natural science as bearing upon agriculture.
2. Mathematics and relations of measurements, and valuations of business methods.
3. Manual work such as will enable him to acquire strength and skill in all the operations required on the farm; and
4. Elevation of his higher nature, to cultivate in him a taste for what is great and good and beautiful in art, history, and in literature."

Take another example from America. L. D. Harvey, State Superintendent, Wisconsin, writes with regard to agriculture and domestic economy in rural industries, as follows (1900):—

"A new class of schools needed in rural communities, to be known as county schools for instruction in agriculture and domestic economy. . . . .

"Extend the idea upon which the county training schools for teachers were organized so as to provide for the establishment of county schools for instruction in agriculture and domestic science. Give to any county establishing such a school State-aid to the amount of at least one-half the sum actually expended for purposes of instruction in such school. Admit to these schools boys and girls who have at least completed the course of instruction in the elementary schools, and who have reached the age of sixteen. Provide for courses such as I have already considered in discussing the body of knowledge which should be taught, including manual training, and make the course two years in length. Add to the courses already indicated such instruction in language, literature, history, and mathematics as may be carried on in connexion with the other work. Such a school should have in connexion with it a small tract of land to be used for illustrative and experimental purposes; not the line of experiments which the agricultural experiment station undertakes, but a more simple line which could be carried on under the direction of the teachers, and which would be of value for observation and training purposes. Such a school could give, in addition to the other work, a great body of the work now given in the short courses in agriculture offered in our agricultural colleges, and it could carry on work in some lines considerably in advance of what is now undertaken in those short courses."

Can any Knowledge of Agriculture and Kindred Subjects be properly taught to Children of from fourteen to seventeen years of age?

As has already been indicated, this question is almost universally answered, in other countries, in the affirmative, but two methods, sharply distinguished from each other, are used to attain the object in view. We have the first method recently adopted in Canada and long in vogue in the National schools of Ireland, in which a text-book on agriculture is placed in the hands of school children, and the lessons committed to memory, with illustrations drawn in some cases from the school garden, to lend a practical interest to these studies. At the other extreme, we have the farm schools of France run upon purely "practical" lines. Here the children were placed in charge of some of the largest and best farmers in the district, the chief attention being devoted to the pupils becoming acquainted with all the practical details of the different operations of agriculture, while the corresponding book work was comparatively neglected. The fact that these schools have, within the last ten years, been completely abandoned in France indicates that, at all events, they do not fulfil the objects for which they were established. Between these two extremes, we find every variety of expedient. In all cases it must be admitted that there is a great deal which children should be taught after they have left the primary schools which ought to fit them for more completely fulfilling the duties of their future sphere of life. The most reasonable position to take, in our opinion, is the stand-point adopted in Denmark, Belgium, Hungary, and some of the leading agricultural States in America adapting their system to the special circumstances of rural life in Victoria. It must be remembered that Victoria differs from almost all other countries in the fact that there are no class distinctions, the vast majority of the farmers are fairly prosperous and hold large areas of land, nearly all avail themselves of our far-reaching system of State

education, and the conditions of labour are such that each farmer has, to a very large extent, to trust to his own exertions. The system, therefore, which answers admirably among the peasant proprietors of Denmark or France cannot be transplanted without alteration to our State. If Denmark and France depend upon their educational systems to keep them in the van of agricultural progress, it needs scarcely to be argued that our farmer requires to be more highly educated still. To compete with foreign countries we require to be able to make full use of all the powers of nature, to utilize our live stock to the best advantage, and make machinery do as much as possible. In other words, we require to be prepared and equipped to take full advantage of every advance which has been made in the theory and practice of agriculture and to adapt our methods promptly to the ever-varying circumstances which competition is bringing about. As an example may be noted the changed outlook with regard to the cultivation of wheat in all parts of Victoria—the old single-furrow plough has been replaced by implements requiring six or eight horses to draw them; 3s. worth of manure to the acre has restored the fertility of the worn-out lands; the well-worked fallow has rendered available much of the locked up fertility of the soil; and all the operations of cultivation and harvesting are carried on by expensive and complicated machines. Scientific methods of storing the grain during last harvest would, in many cases, have been equivalent to an additional 3d. per bushel for the crop. Knowledge, resourcefulness, and business capacity are manifestly of value in every stage of the wheat industry. Precisely similar facts might be quoted to illustrate the importance of knowledge in connexion with all our staple products. Where the activity of the farmer is centred round the animal rather than round the plant, knowledge and resourcefulness become more important still. We take it as beyond question that a farmer's mind requires to be educated in the widest sense of the word, as well as stored with the bare facts of agricultural practice gained from experience alone. To apply his knowledge and experience he requires not only to know what to do, but also to know why he does it. Circumstances and conditions vary so much from year to year that rule-of-thumb methods very soon become obsolete. Therefore, in order to make a success of farming at the present day, it is advisable that the laws of nature as they are found in connexion with the soil, the plant, and the animal, should form subjects of study. A farmer should grow up familiar with the great practical principles which result from an understanding of these laws. Minute details may be left to the higher colleges and university education, but the chief facts should form part of the stock in trade of every one engaged in agriculture. In such subjects as the soil, rainfall and water supply, cultivated plants, animal life, the economics of agriculture, manual training, domestic economy and hygiene, there is a wide range of study bearing directly upon the success of the student in after-life; each and all of them come up before the farmer in his every-day duties; they are the things which he reads about in the newspapers and journals, which take him to the markets and shows, which bring him to town on business, and which, unconsciously perhaps, absorb practically the whole of his mental energy. There is no question at all of their scope and importance. In comparison with them, the amount of knowledge required by the artisan, the manufacturer, or the man of business seems comparatively insignificant. Each of these subjects comprises a wide range of details; and to attain a high standard of excellence in any of them requires

specialization. We seldom find a first-class dairyman who professes to know much about sheep, and *vice versâ*. If a man is to acquire a sound knowledge of the rudiments of them all, it is certain that his education must be carried on systematically and practically. To leave him at the stage where he is left by the present State school syllabus is emphatically not sufficient. His needs should be provided for by a system of continuation schools, in which his studies are kept to those subjects bearing directly upon his life work. The attempt to secure the young farmer after he has left the State school for a number of years, and bring him back to educational work, either at the short courses of study on agricultural subjects or at an agricultural college, does not give satisfactory results. In the meantime, other claims and duties have occupied his time. From the age of fifteen to twenty he has practically fallen out of the habit of serious study. As a general rule, he is not so well up in the ordinary State school curriculum as he was at the time of leaving; and the attempt to resume the habits of study is difficult enough, even were the subjects the same as those he had been formerly accustomed to; and when entirely new subjects are attempted, when, so to speak, he has to learn the language of science from the beginning, failure is almost certain to result. It is attempting to climb up an educational precipice instead of ascending by an inclined plane.

A striking instance of the benefit of using the discipline of education to improve the industrial conditions of society in the country is seen in the case of Denmark. The Danes rely almost entirely on what they call the highly-developed common sense of the farmers. They claim that this is chiefly due to their system of rural high schools; and it is noteworthy that in these high schools there is less attempted on purely practical lines than in any other system of agricultural education of the same grade. It is this system of education which has raised the Danish peasant from being amongst the poorest in Europe to his present position at the top of the tree. It is noteworthy to observe what crises in the history of Danish agriculture have been successfully overcome simply by the intelligence of the farmers. Twenty-five years ago it was found that raising grain for export ceased to be profitable. They immediately changed their system of farming, established their present system of dairying, and bought cheap grain from foreign countries to supply food both for themselves and for their live stock. Hardly had the dairying become fully established when swine fever broke out in a most virulent form. The export of live swine fell from 300.000 in 1886 to 16,000 in 1888, yet they successfully controlled the disease and built up their present ham and bacon industry, which now ranks second in importance to the export of butter. Again, in 1897, it was discovered that nearly half of the dairy cattle in many districts in Denmark were affected with tuberculosis. The farmers set to work at once intelligently to apply the regulations of the Danish Minister of Agriculture, with the result that at the present time the disease has been almost completely eradicated. There is probably no State in the world where the successful carrying out of all details connected with farming interests is left so much to the educated "common sense" of the farmer.

That a judicious combination of science teaching and literary work forms the ideal system for educating the future farmer, in the wider sense of the word, is a proposition that is not likely to be disputed. We have indicated already some of the ways in which this education may be made to equip him specially for the work of the farm. Assuming that the

foundation has been laid in nature-study and in elementary science at the State school, the science of the first year at an agricultural high school might comprise physics, chemistry, mathematics, English, the outlines of physiology and geology, drawing, and bookkeeping (domestic economy and domestic hygiene, if girls are included in the scheme).

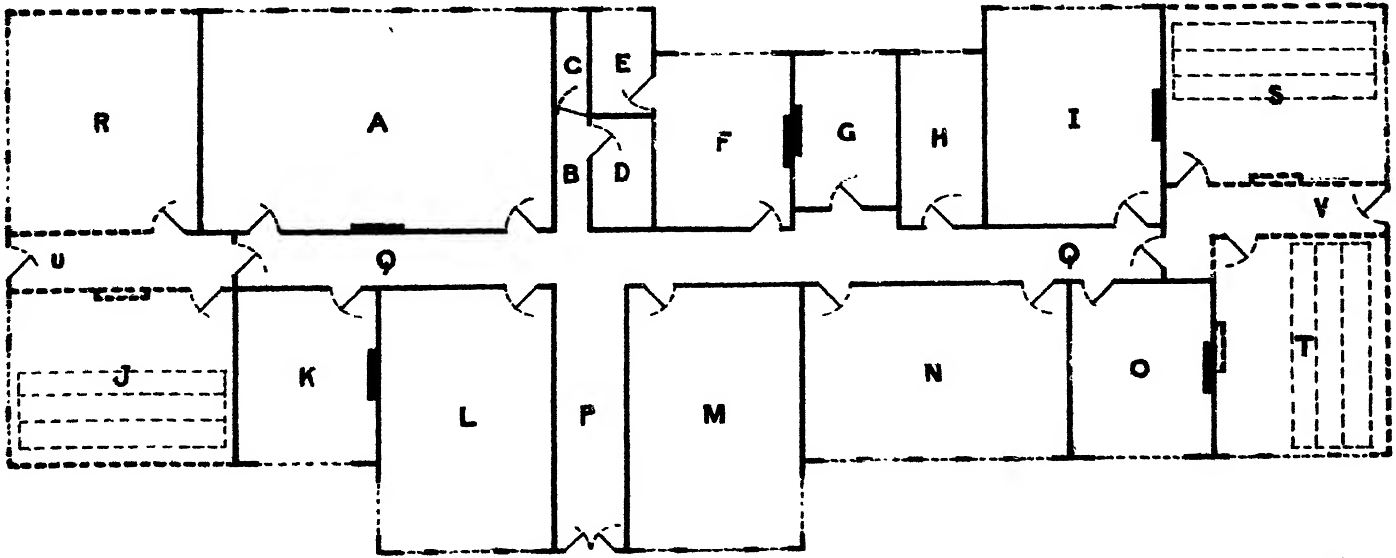
The second-year work, while continuing the English studies, might comprise botany, zoology, meteorology, and agriculture. Under the latter would be included the soil, farm operations, fertilizers, plant production, and the live stock of the farm.

Starting in this way from the great principles which underlie all natural science, and working up gradually to their special application to agriculture, verifying and illustrating each step by the work which the pupil himself does in the practical courses (which would form at least one-third of the total work of the course), we think that agricultural knowledge treated in this way may be made the basis for a fuller and more thorough equipment for the future work of the farmer.

Organization of an Agricultural High School.

In a country centre where an attendance of 50 to 100 pupils could be guaranteed, the Agricultural High School should be worked in connexion with the local State school, controlled by the Education Department, but managed with the advice and co-operation of the Department of Agriculture and a local committee. The staff would consist of teachers specially selected by the Education Department on account of their fitness for work of this kind. The ordinary hours of attendance would be enforced, and the school, generally, conducted on the same lines as the Continuation School in Melbourne, but with all the subjects tending in the direction of agriculture. As already indicated, these subjects would be almost exclusively scientific; and the education would be largely a training of the hand and eye and powers of observation through the medium of practical work. Laboratories, workshops, and an area of land for experimental work would, therefore, be necessary. Its aim would be to impart a sound knowledge of the fundamental principles of the sciences which underlie agriculture, together with a knowledge of the methods by means of which these principles are carried into practical effect.

In a school of this type the aim should be to continue the education of the boys and girls in subjects of direct advantage to them in future life. A small farm should be attached to each of the schools, and in this farm all the ordinary and special operations should be carried out by the students themselves. A sound training in farm methods may be given on a small area of land without difficulty. About two-thirds of the time should be devoted to school and laboratory work, and one-third of the time to practical work on the farm. The heaviest part of the cultivation could be carried out each year with a horse and plough, but after the rough work was thus done, the experimental and demonstration work in connexion with cultivation, drainage, manuring, conservation of moisture, &c., could be carried out on a series of small plots by a few of the students working together. Ample material for the practical work for the advanced classes could be found in special problems, such as selection of seeds, introduction of new varieties, the improving of existing varieties and many other points which involve close observation, extended over a large number of individual specimens of plants.



A	Sloyd room ..	40′ x 25′
B	Corridor, leading to C and D	13′ x 3′ 6″
C	Teachers' lavatory, for washing only	12′ x 3′ 6″
D	Boys' lavatory	13 x 7′ 6″
E	Girls' lavatory ..	12 x 7′ 6″
F	Girls' common room—lockers, hats, &c.	20′ x 16′
G	Teachers' office and sitting-room	18′ x 12′
H	Store-room ..	20′ x 10′
I	Class-room	25′ x 20′
K	Boys' common room—lockers, hats, &c	20′ x 16′
L	Chemistry laboratory ..	30 x 20′
M	Physics and nature study laboratory	30′ x 20′
N	Cookery room ..	30′ x 20′

O	Dining-room ..	20′ x 16′
P	Entrance hall	30′ x 8′
Q	Main corridor	118′ x 6′
U	Exit to boys' offices	
V	Exit to girls' offices	

FUTURE EXTENSION—

J	Class-room	25′ x 20′
R	Metal work-room	25′ x 21′
S	Class-room ..	25′ x 20′
T	Class-room	25′ x 20′
	Additional corridor ..	38′ x 6′

SKETCH PLAN OF AN AGRICULTURAL HIGH SCHOOL TO ACCOMMODATE 100 PUPILS.

(Designed by Mr John Byatt, Inspector of Manual Training, Education Department.)

Such work would develop the faculties, quicken the power of observation, and engage the interests of all the students; while in a few years' time 10 acres of land worked on this principle would constitute a most valuable experimental plot for the purposes of the Agricultural Department. At the present time, upwards of £3,000 a year is spent in experimental work on about 70 plots scattered throughout the whole of Victoria. The weak point of the present system is due to the fact that it is impossible to supervise each plot so as to keep continuous accurate observations going on, and so as to carry out each operation precisely at the right moment. A dozen school farms would, we think, be much more satisfactory from both of these points of view, and furnish results of much greater value than our present experimental plots. Arrangements might be made with the local Agricultural Societies, through representatives on the local committee, to do the ploughing and harrowing when required, and to advise the Director of Agriculture generally with regard to the special management of these plots. The interest of the whole of the surrounding agricultural community would thus be centred in the school. The interest which the children would have in the plots would keep the work under the notice of their parents, and we have no doubt that the influence of the experimental work of the Department of Agriculture would become more far-reaching by this means than by any other method.

The equipment, therefore, for an Agricultural High School would consist of two class-rooms, two or three work-rooms and a school farm of at least 20 acres. The buildings should, if possible, be erected in the same enclosure as the State school, or at all events close at hand; so that the two schools may be under the one head-master, and the staff of the one school be available for special work at the other. The farm should be within reasonable distance—say, not more than 2 miles away—while it would be an advantage to have the farm immediately adjoining the school buildings. We estimate the average cost of the buildings and equipment at £1,500. The land for the farm, for the most part, could be secured from neighbouring public reserves, but an additional £500 would be required for getting the farm in order and equipping it with the necessary tools and appliances for the students. The fees collected from pupils will pay about two-thirds of the cost of tuition in the case of 50 students. In the case of 100 students, the fees will pay nearly the whole cost of tuition.

In districts where Schools of Mines or Technical Colleges are already in existence, it is possible that some arrangement could be made whereby the work of such a college could be amalgamated with the work of the High School. This would necessitate the Department of Education practically taking over the whole control of the college; but as the special circumstances of the School of Mines, &c., vary in each centre, we would suggest that no general scheme be formulated for dealing with them, but that each be treated separately when occasion arises. In any case, only the small Technical Schools would be considered in this connexion.

In order to secure the interest of the farmers in the neighbourhood, a local committee should be formed to assist with its advice in the general curriculum of the school, and to take a specially active part in the work of the school farm and the experimental plots connected therewith. In many cases such a committee could be elected by municipal councils, agricultural societies, and private subscribers to the funds of the High School. They would not have power to appoint or dismiss teachers directly;

but by giving them an active part in selecting the teachers from a list supplied by the Department, and in co-operating with the Department of Agriculture in the cultivation and general management of the plots, there is little doubt that sufficient local interest would be maintained to secure the co-operation of an active committee.

Regulations.

1. The Minister of Public Instruction may establish Continuation Schools, to be called Agricultural High Schools, under the following conditions:—

(*a*) At least one-half of the cost of the necessary buildings and equipment shall be contributed by local subscription.

(*b*) An area of ground of not less than 20 acres, situated in a position convenient to the High School, shall be provided, and vested in the Minister.

(*c*) At least 50 students paying prescribed fees shall be guaranteed before a proposal to establish a High School is entertained.

2. (*a*) Agricultural High Schools shall be under the control of the Minister, who will be assisted in the questions affecting course of study and general policy by a committee, consisting of the Minister of Agriculture, the Director of Education, and the Director of Agriculture.

(*b*) A local council, consisting of five members, to be appointed by the Governor in Council, shall be established for each district High School. Their duties will be to exercise a general oversight in matters affecting their school, to expend the maintenance allowance allotted to each school, to exercise such supervision as the Minister may authorize over the farm operations, and to advise the Minister in all matters specially pertaining to the school.

3. The qualifications for enrolment of students shall be as follow:—

(*a*) Pupils must have obtained the Certificate of Merit, or must have passed the primary or some higher examination of the Melbourne University; or must have satisfied an inspector of schools that they are qualified to profit by the course of study in such school.

(*b*) They must furnish satisfactory evidence that they are of good moral character, and of good general health.

(*c*) They must be at least fourteen years of age at the date of enrolment.

4. The Minister may grant in each year scholarships entitling holders thereof to free tuition for two or more years in any approved courses of study prescribed in Agricultural High Schools.

5. The Council of any Agricultural High School may nominate for free instruction in any prescribed courses of study in that school students who possess the qualifications stated in section 3, provided that the number of students so nominated shall not in any year exceed 10 per cent. of the total number of students paying full fees enrolled in that school.

6. The course of study shall include such subjects as may be determined upon by the Minister, with the advice of the committee named in section 2*a*.

7. At least one-third of the time devoted to instruction shall be spent in the study (both practical and theoretical) of the sciences bearing upon agriculture, and one-third of the time shall be devoted to manual and practical work on the school farm or in the school workshop.

8. During their course in an Agricultural High School, students will be required to attend lessons regularly and punctually in the subjects prescribed for their course, and may further be required to devote such time to practical outdoor work as the Principal may direct.

9. The fees to be paid by pupils shall be £8 8s. per annum, payable quarterly in advance.

10. No pupil shall be enrolled after the expiration of the first quarter unless with the special sanction of the Director of Education.

11. Any students may be excluded from attendance at the school on the ground of idleness or misconduct.

12. Holders of scholarships under Regulation XXI. 1(*b*) may be admitted as students at any Agricultural High School, and attendance at such school shall be held to comply with the conditions laid down in such Regulation for attendance at a Continuation School or Secondary School.

13. Candidates for admission to the teaching service of the Education Department may be admitted to an Agricultural High School under the conditions of Regulation X. for admission to a Continuation School, and all the provisions of such Regulation so far as they may be applicable shall be held to apply to Agricultural High Schools as regards such students.

DUCKS FOR EXPORT.

A. Hart, Poultry Expert.

The excellent results which have been obtained with the trial shipments of ducklings sent to Great Britain from Victoria must prove satisfactory to all parties interested in the export trade. It is certainly very encouraging to breeders, and there appears every indication of a very valuable and extensive business being established in the export of ducklings and poultry to the London market, *provided that the birds sent are suitable to the requirements of the trade.* The price realized for one shipment was 6s. 10d. per pair, and in a rather unfavorable market. This point, coupled with the fact that trial shipments are looked upon by the London dealers with a certain amount of suspicion, goes to prove that it is certain that higher prices will be obtained when a suitable market is experienced, and the shipments of ducklings become an established and regular supply on the London markets. There is an almost unlimited demand for both ducklings and chickens in Great Britain, and the enormous quantity of poultry consumed there every year should certainly be, to a certain extent, supplied by this and our neighbouring States.

The main requisites towards a successful export trade from Victoria to Great Britain are as follow:—

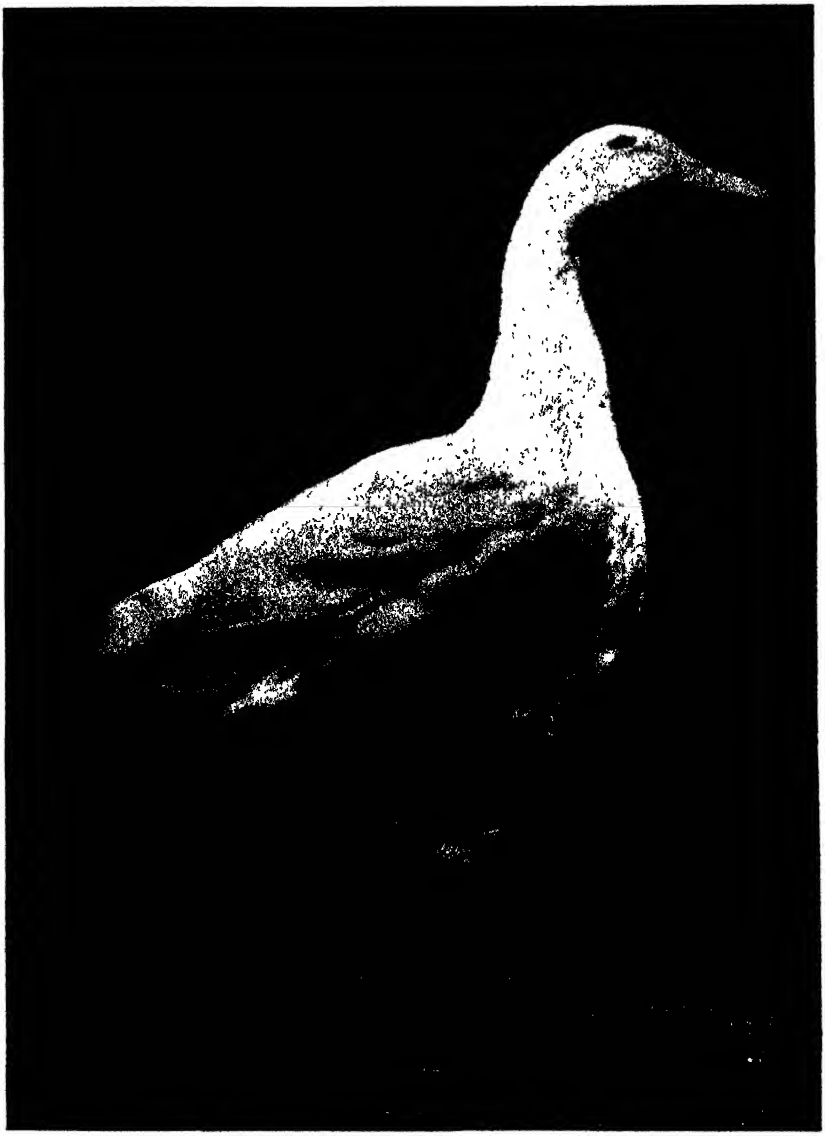
1. The breeding of birds which will command the highest value in the London market.

2. The rearing and fattening of the birds at as early an age as possible.

3. The killing, grading, and packing to be performed with great care, so as to insure the poultry being landed in good condition, and presenting a good appearance, and therefore likely to prove satisfactory to the consumer.

4. Selecting the proper seasons for shipment of both ducklings and chickens.

5. A proper supervision at the receiving depôt. and the appointment of direct agents, who will give the industry their undivided attention, and thereby minimize the cost of handling and placing on the market.



YOUNG AYLESBURY DUCK, WEIGHT 9 LBS.

The duck-breeding industry has attained enormous proportions in America, and many breeders are making the business a very profitable undertaking on a large scale. Mr. J. Rankin breeds 10,000 young ducks

yearly, and makes them pay handsomely. At the village of Eastport. Massachussets, it is estimated that not less than 500,000 spring ducklings are reared every year within a radius of 8 miles. Another very extensive duck farm is run by Mr. B. F. Bremdred, Crystal Springs, Pennsylvania. The annual output of this farm is from 35,000 to 40,000 spring ducklings and 5,000 chickens every year. These figures are only a sample of many which might be quoted, and go to prove as to how large an extent the duck-breeding industry can be made, and with payable results. If these results can be obtained in America, there is not the slightest reason why they should not be produced in our State, where the general conditions attending duck-rearing, feeding, &c., are quite equal to those of America, and in some cases even better. We cannot of course expect to equal the above figures for some time to come. An industry of this kind has to be established on a sound basis, and grow and develop with time and experience. There are, however, very encouraging prospects offered in the export trade of ducklings, and breeders have the final result practically in their own hands. If they begin on correct lines and produce birds which are of the requisite quality and condition, it is quite probable that this industry may assume very large proportions in the near future.

The following extract from *The Age* of 16th June gives the views of a Smithfield (England) dealer on Australasian poultry in the British markets. He says:—"From the criticisms passed by leading dealers on the consignments of ducklings, turkeys, and chickens which have been received within the last few weeks at Smithfield from Victoria and Queensland, it appears that there can no longer be any doubt as to the ability of Australia."

HINTS TO BEGINNERS.

To obtain the best results in breeding for market, you must start with pure-bred stock, and set the eggs from your own birds.

Aylesbury drake with Pekin ducks makes a suitable cross for export. Allow three or four ducks to each drake. This cross matures quickly, and grows to a large size, with flesh of good flavour, colour, and texture.

Use first season drakes with second season ducks, or *vice versâ*.

See that your breeding ducks are comfortably housed in cold weather, so as to keep up the egg supply. A ground floor is the best for ducks. It should be of clay, well rammed down, and raised a few inches above the level of the ground.

All ducks should be bedded down with straw, pine needles, shavings, &c., in the laying season, so as to keep the eggs clean.

A variety of food should be given to the drakes during the breeding season, as a vigorous condition is necessary to fertilize the eggs.

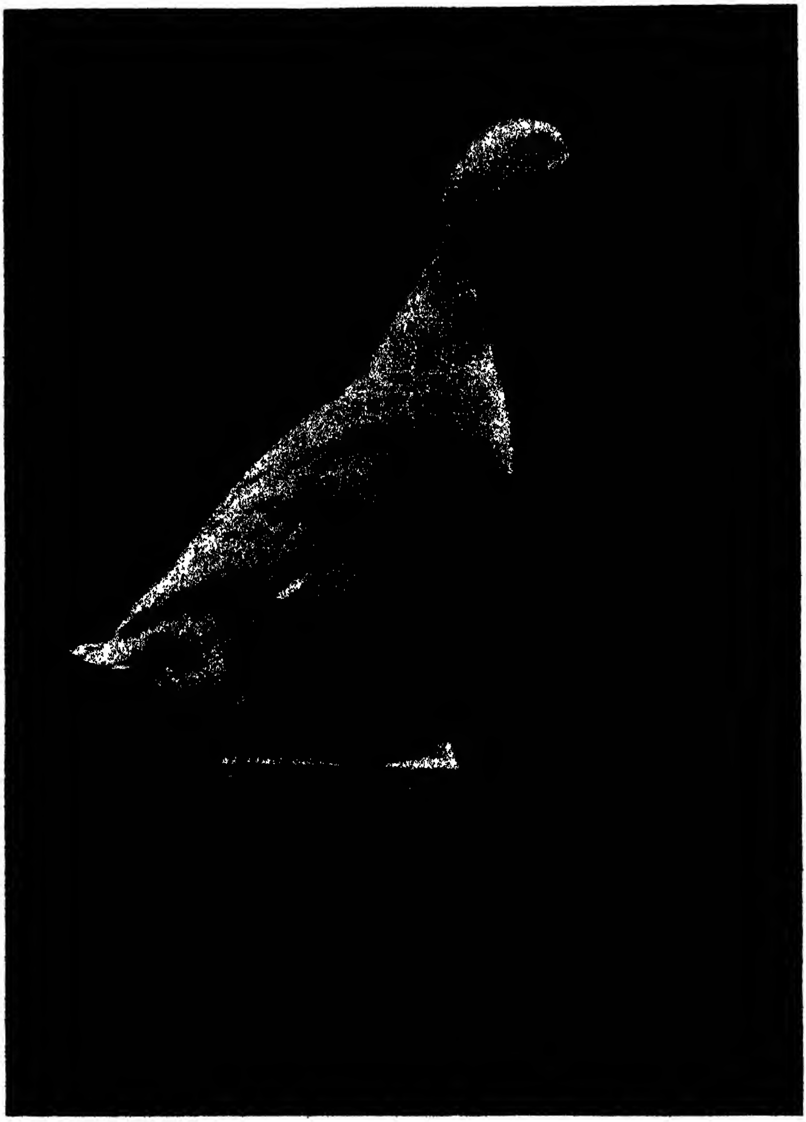
Breeding pens of ducks should be kept strictly to themselves.

Access to water should be allowed occasionally to breeding ducks to obtain best fertilizing results.

Ducks should not be allowed in the water when the weather is very cold or frosty.

Use hen turkeys for incubation. Give them a teaspoonful of port wine, and they can be made to set at any time. Place the turkey on some china eggs at first in a dark box where she cannot stand up properly, and as soon as she takes to the nest, put the duck eggs under her. They may be set twice without injury if fed and watered regularly every day.

All duck eggs should be tested on the seventh day, and the infertile eggs removed. Night is the best time for the examination.



YOUNG PEKIN DUCK, WEIGHT 8 LBS.

A cheap foster-mother for young ducks can be made out of a kerosene case placed on its flat. Put a quart flat bottle filled with hot water in the centre of the box. Cover it with brown paper, and then put sawdust, chaff, or straw over it. This will provide warmth for the ducklings, but

is only to be used when small numbers are reared or in cases where proper brooders cannot be procured.

Incubators that allow of plenty of moisture to the eggs are the most suitable machines for hatching duck eggs.

The best green stuff to grow for ducks is maize, which should be cut young. Thousand-headed kale, lucerne, rape, and all other green food should all be chaffed and mixed with the soft food.

Store your grain and meal in the months of January and February, when it is cheap. Old piano cases, tin lined, are very suitable bins.

To start young ducks, and also young ones after moulting, to lay, use maize meal with a little green cut bone for the winter months in their morning meal.

The best food for old ducks is two parts pollard, one bran, one lucerne and chaff, adding a little salt. The chaff should be scalded and steamed in a covered vessel. All food should be given fairly soft, and fed in "V"-shaped troughs. They can be made with two 6-inch flooring boards nailed together, and cross pieces at the ends to keep them steady. A trough 8 feet long will do for eighteen or twenty ducks.

All grit should be given to ducks in water, using a shallow dish so that they cannot get their eyes under the water. Grit masticates the food, and increases condition and also egg supply.

Animal food should be given two or three times a week.

Always buy the best quality of grain or other food. It is the cheapest in the end.

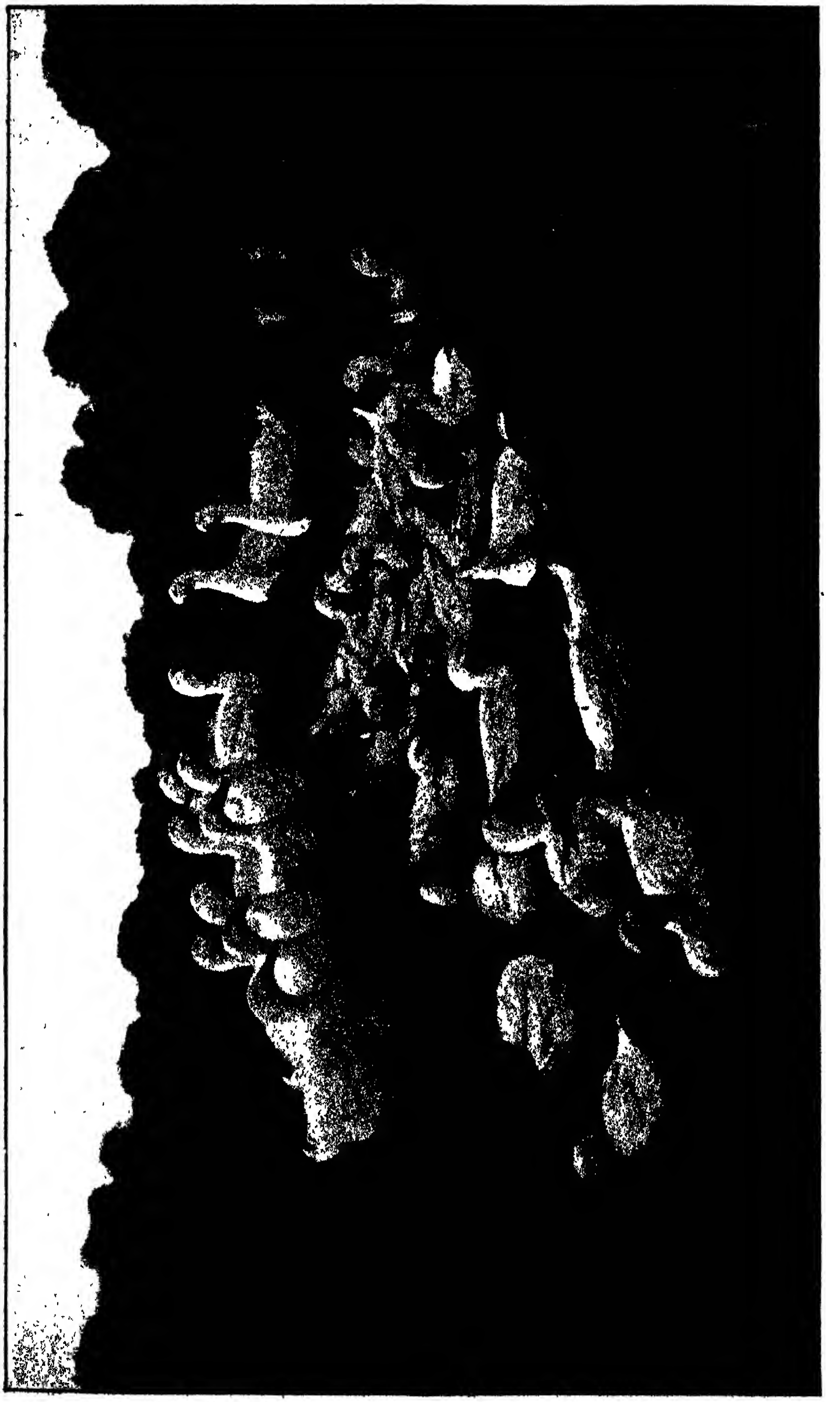
Cottage holders should make the nests on the ground when using hens to incubate duck eggs.

Have your thermometers tested every season, as they are very liable to get out of order.

THERE IS MONEY IN DUCKLINGS.

Ducklings are more profitable to cottage holders than chickens, as they are hardier, mature more quickly, and can be marketed at little more than half the age. There is always a sale for export poultry of excellent quality delivered on the London market in satisfactory condition. Most of the white Aylesbury and Pekin ducklings sent there from Melbourne are described as particularly fine birds, and suited to the requirements of the best West End trade. They realized 6s. 10d. per pair, though it happened that the state of the market was rather unfavorable. Had the general demand been better they would have brought from 8s. to 8s. 6d. per pair, according to the wholesale dealer who sold them. Queensland chickens, which had been killed two months, were sold at 3s. 3d. each, and hen turkeys from the same State realized 9d. per lb.

During the twelve months ending 30th June, 1905, Victoria exported 46,708 head of frozen poultry. This number could have been increased tenfold if the quality of the birds sent in to market had been of the desired quality and condition. One point which should be of much value to the producer of ducklings and chickens is that all poultry for export is purchased by weight. The price paid last season was 6d. per lb. live weight. This should certainly induce poultry breeders to feed their birds liberally, and produce weight in them, as it is known with a degree of certainty that they are likely to realize payable prices, both locally and for export, practically all the year round. These prices are not influenced in any way by a rising or falling market for well-fattened ducklings.



AN IDEAL DUCK POND, WITH SHELTER, WHICH IS A NECESSITY FOR SUCCESSFUL DUCK-BREEDING

The best food for young ducks for quick maturing is pollard, barley meal, bran, rendered fat, and skim milk. Nothing will mature them quicker than milk. All meal should be scalded, and drinking water given occasionally.

All eggs found infertile when testing may be sold or given to the young ducks.

The best age to market ducklings is from nine to eleven weeks old, when they are in their first feather.

Farmers, in sending birds to market, should grade them as near to age, weight, and condition as possible. Condition and uniformity in size will always top the market, either in London or locally.

Ducklings for market should not be allowed in water. They should be kept in pens of moderate size, which should be warm, high and dry. Keep them in lots of 25 or less, and feed four times a day from the time they leave the shell.

Give ducklings a little bone meal twice a week in their morning food. It will increase the size and prevent leg weakness.

The best months for matured ducks in our local markets are June, July, and August.

The best months for export ducklings to ship from here to the London market are November, December, and January.

All young ducklings, when being fattened for market, should be penned as even in size as possible. The smaller ones will not get as much food as the larger, and their size and growth will be retarded.

All ducklings exported from Victoria were passed by the Government expert, and after leaving his hands they were weighed, and the vendors paid for them in cash on the same day.

The charges made by the Department to the shipper, which cover grading, plucking, packing (including case), and freezing, amount to 7d. per pair for ducklings and chickens, and 1s. per pair for turkeys and geese. No charges are set down to the vendor.

The Department of Agriculture does not buy poultry, but receives same alive if suitable for export, kills, plucks, dresses, provides packages, packs, freezes, and ships on account of consignors at the rates above mentioned.

The following are the names and addresses of poultry exporters who are prepared to purchase outright for export, or ship for producers on consignment. Poultry growers should write to any one of these firms beforehand, and get particulars of prices and conditions. If satisfactory arrangements can be made, a letter asking for railway poultry crates for the number and class of birds should follow:—

POULTRY EXPORTERS.

Angliss and Company ...	44 Bourke-street, Melbourne.
Borrett, J. R.	6 Fish Market, Spencer-street, Melbourne.
Bradbury, J. W. H. ...	City Markets,, Flinders-street, Melbourne.
Cooke, John	Corner Collins and King streets, Melbourne.
Joubert and Joubert ...	552 Flinders-street Melbourne.
MacMeikan, N. H. ...	495 Collins-street, Melbourne.
Meadows, N. E.	Flinders-street, Melbourne.
McMeekin Brothers ...	547 Flinders-street, Melbourne.
Watson and Company ...	Spencer-street, Melbourne.

Should growers be unable to make unsatisfactory sales locally, and desire to export on their own account, or through an agent, they are recommended to consign to any of the following firms:—

LONDON POULTRY SALESMEN.

Broome, F.	263, 264, 266 Central Markets, Smithfield, London, E.C.
Brooke Brothers ...	206, 207, 307, 308 Central Markets, Smithfield, London, E.C.
Freeman, J. J., & Company	208 and 209 Central Markets, Smithfield, London, E.C.
Keevil and Weston ...	228, 231 Central Markets, Smithfield, London, E.C.
Kerry, Hull, and Juniper	369 Central Markets, Smithfield, London, E.C.
Walkden and Company ...	275 Central Markets, Smithfield, London, E.C.
Weatherly, E.	246, 248 Central Markets, Smithfield, London, E.C.
Webb, Henry John ...	377, 376, and 329 Central Markets, Smithfield, London, E.C.

Poultry for export should be legibly addressed and consigned to "The Superintendent of Exports, Government Cool Stores, City Markets, Flinders street, Melbourne." Railway carriage right through must be prepaid. *At the time of despatch*, a letter giving full particulars of the number and class of birds, the name of the agent (if to be shipped through one), and the name of the Melbourne agent to whom rejects (if any) are to be delivered to should also be sent to the Superintendent of Exports. In the event of no agent being employed, instructions should be given as to payment of charges and ocean freight, &c., and disposal of bills of lading, together with name of steamer and consignee.

WHEAT EXPERIMENTS.

ABRIDGED FROM THE REPORT ON THE EXPERIMENTAL WHEAT CROPS GROWN DURING THE SEASON 1905.

F. E. Lee, Agricultural Superintendent.

It is now some few years since any comprehensive experimental work has been conducted by the Agricultural Department in the northern wheat areas. The attention of those interested will again be aroused by the harvest returns of a number of large experimental areas, established with the purpose of studying farming problems in the north, over a continuous term of seven years. The late Chemist for Agriculture, Dr. Howell, obtained authority to establish these semi-permanent areas, the owners of the land undertaking, under a signed agreement, to carry out the Department's wishes over a period of years.

OBJECTS OF THE EXPERIMENT.

In any experiment conducted on a large scale, and over an extended period, there naturally arise a number of matters requiring systematic investigation. One of the most prominent features in connexion with

wheat farming to-day is whether the present requirements of the Mallee, Wimmera, and Goulburn Valley soils will continue to be adequately filled by the use of phosphatic manures alone for an indefinite period. Farmers are also commencing to inquire what will be the effect of the continuous use of one class of manure only, and whether the present cheap and effective means of meeting soil deficiencies may not conceal some obscure penalty, the consequences of which may imperil the great grain industry. The expansion of the trade in fat lambs has awakened the northern farmer to the consciousness that his operations must be arranged so as to permit of the regular feeding of his stock, if the best results are to be looked for. This means fodder crops, and at the same time calls for knowledge as to which are the crops that can be most advantageously rotated with cereals.

Improvements in the methods of cultivation, often the result of accident, have shown the enormous capabilities of development in this direction. While radical changes are not contemplated, there are abundant grounds for the belief that improved cultural operations will play a more prominent part in crop production than has been the case since the use of artificial manures became general. There are few, I believe, who will dispute the statement that the manure is too often called upon to grow the crop, and the most perfunctory assistance is rendered by the cultural operations.

Broadly speaking, the experimental fields comprise:—

(1) Manurial tests.
(2) Cultivation trials.
(3) The introduction of new wheat and oat varieties.
(4) Green manuring.
(5) Fodder crops for ensilage and green feed purposes.

Constitution of the Fields.

Each field is approximately 11 acres in extent, and is divided into four distinct sections, lettered A, B, C, and D. Section A is 1¾ acres, and has been dressed with different forms and amounts of phosphatic manures, both singly and combined with nitrogenous forms. Potassic manures also find a place in the complete dressings given in some plots.

Section B, representing 1¾ acres, has, in addition to receiving exactly similar dressings of manures as in A, been subsoiled.

Highly interesting comparisons of the effects of manures may thus be drawn between non-subsoiled and subsoiled land.

Section C, in area about 2½ acres, was devoted to the trial of new and improved varieties of wheat and oats, a report of which has already appeared in the March number of the *Journal*.

Section D, comprising about 4½ acres, was set apart for the growth of crops suitable for ensilage and green feed purposes, a detailed report of which will appear later.

Subsoiling.

Before entering into a criticism of the harvest results of the various sections, it may not be out of place to explain that the subsoiling of the fields was, in the great majority of cases, done at such a late period that the first year's results should only be accepted with caution.

The subsoiling was done by means of two single-furrow ploughs, one minus the mould board, following the other in the same furrow, and stirring the subsoil to an average depth of 9 or 10 inches. To be thoroughly effective, subsoiling should be done at the time of fallowing, whereas most of the fields were not completed till the months of November and December, and some not till January and February, just prior to sowing in April. When it is remembered that one of the principal reasons for subsoiling is to conserve rainfall, it is not difficult to understand that this trial has not yet had an opportunity of showing what it is capable of doing in the drier portions of the State. I have ascertained, by wide inquiry from farmers, that at least an extra bag of wheat per acre will require to be produced before subsoiling can be said to pay. This statement may yet have to be modified, and with the introduction of a suitable implement, there is little doubt that the cost can be reduced.

MANURE DRESSINGS.

The manurial dressings of Sections A and B were applied at the following rates per acre:—

Section A	Section B.	
Plot 1	33	40 lbs. ordinary superphosphate.
,, 2	34	No manure.
,, 3	35	56 lbs. ordinary superphosphate.
,, 4	36	75 lbs. ordinary superphosphate.
,, 5	37	No manure
,, 6	38	16 lbs concentrated superphosphate.
,, 7	39	22 lbs. concentrated superphosphate
,, 8	40	No manure.
,, 9	41	30 lbs. concentrated superphosphate.
,, 10	42	58 lbs. Thomas' phosphate.
,, 11	43	No manure.
,, 12	47	56 lbs. superphosphate, and 28 lbs. sulphate of ammonia.
,, 13	48	56 lbs. superphosphate, and 30 lbs. nitrate of soda.
,, 14	49	No. manure.
,, 17	46	No manure.
,, 18	50	56 lbs. superphosphate, and 56 lbs. sulphate of ammonia.
,, 19	51	56 lbs. superphosphate, and 60 lbs. nitrate of soda.
,, 20	52	No manure.
,, 21	53	56 lbs. superphosphate, 28 lbs. sulphate of ammonia, and 28 lbs. potash chloride.
,, 22	54	56 lbs. superphosphate, 30 lbs. nitrate of soda, and 28 lbs. potash sulphate.
,, 23	55	No manure.

Plots 15 and 16 in Section A, and 44 and 45 in Section B, were manured with 56 lbs. superphosphate per acre, but were used as path plots.

Section C received a uniform dressing of ordinary superphosphate at the rate of 56 lbs. per acre.

OTHER MANURIAL DRESSINGS.

In sections A and B, plots of rape, peas, and clover, dressed with superphosphate and Thomas' superphosphate, were ploughed down for green manure when in full bloom. When these sections are cropped again, especial notice will be taken of their effect on the yield of grain.

Wheat Harvest Returns—Section A (not Subsoiled).

Dressings per Acre.

Experimenter.	40 lbs Ordinary Superphosphate.	No Manure	56 lbs. Ordinary Superphosphate	75 lbs Ordinary Superphosphate	No Manure	16 lbs Concentd. Superphosphate	22 lbs Concentd. Superphosphate	No Manure	30 lbs Concentd Superphosphate.	58 lbs Thomas' Phosphate	No Manure.	56 lbs Ordinary Superphosphate and 28 lbs. Sulphate of Ammonia	56 lbs Ordinary Superphosphate and 30 lbs Nitrate of Soda.	No Manure.	No Manure	56 lbs. Ordinary Superphosphate and 56 lbs Sulphate of Ammonia.	56 lbs. Ordinary Superphosphate and 60 lbs Nitrate of Soda.	No Manure.	56 lbs Ordinary Superphosphate, 28 lbs Sulphate of Ammonia, and 28 lbs. Potash Chloride	56 lbs. Ordinary Superphosphate, 30 lbs. Nitrate of Soda, and 28 lbs. Potash Sulphate.	No Manure.
Plot ..	1	2	3	4	5	6	7	8	9	10	11	12	13	14	17	18	19	20	21	22	23
Mallee and Mallee Fringe.																					
Innes, D. B., Rainbow ..	21.6	18.5	20.5	20.8	19 8	17.9	19 5	17.3	19 0	19.8	18.1	19 5	21.8	17 2	17 4	18.0	19.1	18.1	18 2	18.8	17.6
Allen, J., Willenabrina ..	8.6	8.0	8.6	9.6	4.5	7.8	8 2	5.0	9.2	6.0	5.9	10.1	10.2	6.7	7.0	10.0	10.1	6 1	10.2	9.1	4.0
Witney, J. B., Jeparit ..	6.0	2.6	10.0	7.3	2.8	5.8	5.8	2.9	8.1	4.5	2.8	7.1	6.5	3 1	2 8	8.6	9.8	3 5	6.5	8.3	5.0
Milbourne, J., Warracknabeal	18.6	12.3	20.5	19.0	10.6	18.3	19.0	10.6	19.3	10.3	9.0	17.6	15.6	9 3	9.0	13.6	14.3	8 6	12.6	13.0	5.6
Lavery, B., Watchem ..	16.0	10.8	17.9	19.2	10.0	17.5	18 5	9.6	17.3	12.0	10.8	17.5	16.5	9.8	7.8	18.6	21.6	9.5	16 9	18.5	9.7
Mudge, J., Sea Lake ..	17.0	14.0	18.0	19.0	15 0	17.5	17.1	15 8	17.8	16.3	15.0	18.3	18.5	14 3	15.6	18.5	17.0	14.6	18.5	17.8	13.0
Barber, A., Wycheproof ..	7.1	9.0	12.6	13.3	10.8	15.0	15 1	12.5	17.1	13.6	12 1	13.6	14.0	9.8	10.0	12.8	11.8	9.5	12.6	12.3	10.3
Williamson, W., Boort ..	15.0	9.8	15.4	18.3	13 5	15.6	17 1	12.1	19.6	18 3	12.5	18.5	18 3	13.3	11.1	15 2	16 6	12 5	14.1	13 8	10.0
Average Yield per Acre ..	13.7	10.6	15.4	15.8	10.8	14.4	15.0	10.7	15.9	12.6	10 7	15.2	15.1	10 4	10 0	14.4	15.0	10.3	13.7	13.9	9 4
Wimmera District.																					
Feery, J., Dimboola ..	15.3	9.1	17.3	17.5	10.5	16.0	16.8	10.1	19.3	12 1	10 0	16.2	17.0	10 1	12.1	17 8	18.3	13.0	17.0	17.1	11.1
Gibbins, E., Wail	17.8	14.1	20.0	20.5	13.0	15.6	17.6	10.3	20 0	18.3	10.5	18.8	20 3	12.6	11.6	20.0	20.3	13.3	21.0	21.6	14.6
Nowatna, C., Jung ..	22.0	12.0	23.3	18.3	17.8	23.3	24.1	17.8	25.5	19 3	17 3	23 5	24.8	15.0	13 6	20.0	20.5	14 0	19.5	20.8	12 0
Tepper, P., Coromby ..	18.3	16.1	21.1	22.5	16.5	20.5	22.1	16.8	23.1	17 1	14.8	20.8	21 1	15.0	14.6	19.8	20.3	14.3	19.0	20.8	15.5
Hutchings, A., Lubeck ..	29.3	23.6	29.6	33.3	23.3	27.3	34.1	22 3	34 0	27.3	23 3	30 5	30 6	20.0	23.6	27.3	30.0	22.6	31.3	32.0	22.3
Average Yield per Acre ..	20.5	13.1	22.2	22.4	16.2	20.5	22.9	15 4	24.3	17 6	15.1	21.9	22 7	14.5	15.1	20.9	21.8	15 4	21.5	22.4	15.1
North and North-east Plains.																					
Sproat, W., Donald ..	22.6	18.5	20.8	18.6	15.1	21.7	23.5	18 8	24 5	21.3	19 8	23.5	24.3	21.0	19.6	24 0	20 0	18.5	22.1	21.8	16.3
Nixon Bros., Eddington ..	10.0	6.0	10.3	13.5	9.3	13.0	12.1	7.3	16 5	17 3	11 6	17.0	17.6	14.6	14.3	17.3	18.3	12.3	15.3	17.0	9.0
Howard, J., Bet Bet ..	8.8	7.1	10.3	9.6	8.0	9.6	9 8	6.6	8 5	11.0	8.3	11.5	10.1	7.1	7.1	10.8	10.0	7.0	10.1	11.3	8.0
Hunter Bros., Elmore ..	29.0	20.6	31.1	27.0	24.3	25.3	29.3	20.0	30 6	24 6	24.3	27.3	32 3	22.0	25.3	28.6	32 0	23.3	30.0	28.0	20.0
Bray, W., Merrigum ..	18.3	16.6	24.6	25.3	18.0	21.0	25.6	19 3	26.6	20.3	15.6	25.0	22.3	17.3	18.0	23.3	23.6	16.0	21.6	21.6	15.3
Sharp, T., Goorambat ..	19.3	18.0	23 6	22.6	17.1	20.6	20.5	16.1	20.8	20 6	17.1	22.0	22 8	16.5	18.6	24 6	25.7	17.3	22.0	23.1	18.6
Average Yield per Acre ..	18.0	14.4	20.1	19.4	15.3	18.5	20.1	14.6	21.2	19.1	16.1	21.0	21.5	16 4	17.1	21.4	21.6	15.7	20.1	20.4	14.5
Average for 19 Fields ..	16.8	13.3	18.7	18.6	13 6	17.3	18.7	13.2	19.8	16.0	13.6	18.8	19.1	13.3	13.6	18.3	18.9	13 3	17.8	18.2	12.5
Increase due to Manures	3.5	..	5.4	5.0	..	3.7	5.5	..	6 6	2.4	..	5.2	5 8	..	..	4.7	5.6	..	4.5	5.7	..

Wheat Harvest Returns—Section B (Subsoiled).

Dressings per Acre

Experimenter.	40 lbs. Ordinary Superphosphate.	No Manure.	56 lbs Ordinary Superphosphate	75 lbs. Ordinary Superphosphate.	No Manure.	16 lbs Concentd. Superphosphate.	22 lbs Concentd. Superphosphate	No Manure	30 lbs Concentd Superphosphate	58 lbs Thomas' Phosphate.	No Manure	No Manure	56 lbs Ordinary Superphosphate and 28 lbs Sulphate of Ammonia.	56 lbs Ordinary Superphosphate and 30 lbs Nitrate of Soda	No Manure	56 lbs Ordinary Superphosphate and 56 lbs Sulphate of Ammonia.	56 lbs. Ordinary Superphosphate and 60 lbs Nitrate of Soda.	No Manure.	56 lbs Ordinary Superphosphate, 28 lbs. Sulphate of Ammonia, and 28 lbs Potash Chloride.	56 lbs. Ordinary Superphosphate, 30 lbs. Nitrate of Soda, and 28 lbs. Potash Sulphate.	No Manure.
Plot ..	33	34	35	36	37	38	39	40	41	42	43	46	47	48	49	50	51	52	53	54	55
Mallee and Mallee Fringe.																					
Innes, D. B., Rainbow ..	21.3	17.5	17.5	17.8	16.5	18.5	19.1	16.3	18.5	19.0	17.3	16.7	17.2	18.5	16.5	17.5	17.7	16.7	18.2	19.0	17.0
Allen, J., Willenabrina ..	7.6	4.0	7.6	9.5	5.5	8.8	8.8	3.6	12.9	6.8	6.2	5.3	9.3	11.6	6.1	12.5	12.2	9.4	11.8	10.0	4.3
Witney, J. B., Jeparit ..	7.0	4.1	8.0	7.8	2.6	5.8	6.0	3.0	6.8	6.7	3.4	3.1	7.5	8.1	3.5	7.5	7.0	3.3	7.2	8.0	5.5
Milbourne, J., Warracknabeal	11.6	6.0	13.0	15.1	6.6	11.6	12.6	6.0	15.6	6.6	7.0	5.6	12.6	9.6	5.6	13.5	13.0	6.6	13.0	13.3	7.3
Lavery, B., Watchem ..	18.5	10.8	19.9	21.6	12.0	19.6	20.6	13.1	21.8	16.4	13.4	15.6	22.5	22.3	13.3	23.6	23.4	15.4	20.8	20.8	12.8
Mudge, J., Sea Lake ..	17.3	16.1	17.0	19.3	15.0	17.0	19.3	15.1	20.6	16.8	16.0	14.5	19.1	18.3	14.0	18.5	14.6	15.0	18.1	20.3	11.8
Barber, A., Wycheproof ..	17.5	14.1	16.8	17.3	12.8	16.3	16.5	12.3	16.3	11.5	12.8	14.1	17.6	15.8	13.6	16.5	15.8	12.8	16.1	16.3	13.0
Williamson, W., Boort ..	13.2	9.0	12.6	13.1	9.8	11.8	11.3	7.1	11.3	10.8	7.6	9.1	14.8	14.3	11.0	14.1	12.6	8.6	15.0	15.8	9.7
Average Yield per Acre ..	14.2	10.2	14.0	15.1	10.1	13.6	14.2	9.5	15.4	11.8	10.4	10.5	15.0	14.8	10.4	15.4	14.5	10.9	15.0	15.4	11.1
Wimmera District.																					
Feery, J., Dimboola ..	15.7	8.8	15.3	17.3	11.0	16.6	19.1	13.3	21.0	12.5	11.6	9.8	20.0	19.3	13.6	22.1	12.0	19.0	19.4	23.8	9.5
Gibbins, E., Wail	21.5	14.6	21.6	22.5	12.6	18.6	21.3	13.3	22.0	14.0	14.0	14.0	26.1	24.8	13.3	21.3	20.6	12.6	22.0	20.6	14.5
Nowatna, C., Jung ..	15.5	10.0	17.0	19.5	11.1	17.8	17.8	10.1	19.1	13.1	7.8	11.6	19.1	18.6	12.6	18.5	17.5	10.8	17.0	17.3	8.5
Tepper, P., Coromby ..	19.5	13.5	19.1	21.1	13.6	18.9	20.5	13.0	21.6	18.0	12.1	11.3	21.1	20.8	11.8	21.0	20.3	11.1	19.8	21.5	12.8
Average Yield per Acre ..	18.0	11.7	18.2	20.1	12.0	17.9	19.6	12.4	20.9	14.4	11.3	11.6	21.5	20.8	12.8	20.7	17.6	13.3	19.5	20.8	11.3
North and North-East Plains.																					
Sproat, W., Donald ..	22.3	20.8	23.3	24.1	20.6	23.6	24.0	21.0	23.1	20.6	20.1	20.8	25.0	24.3	21.8	24.0	24.1	20.8	25.1	24.6	21.0
Nixon Bros., Eddington .	21.6	17.3	21.6	23.1	17.5	22.5	21.5	19.6	23.3	23.6	19.0	16.1	22.0	21.3	17.3	20.8	22.0	18.3	22.0	22.1	14.0
Howard, J., Bet Bet ..	11.8	10.1	13.5	12.0	10.3	13.3	14.8	11.6	14.3	12.3	11.3	11.8	16.0	15.5	11.8	17.0	17.0	12.3	15.6	16.0	11.3
Hunter Bros., Elmore ..	22.6	21.6	26.6	20.6	25.3	28.3	28.3	23.3	28.0	22.8	24.0	19.6	27.0	29.6	19.6	26.6	27.0	26.6	27.6	32.6	20.3
Bray, W., Merrigum ..	25.3	20.6	27.0	26.0	22.0	25.3	25.0	19.6	27.3	23.6	16.3	16.6	24.0	25.8	17.8	24.5	23.0	18.0	24.0	22.3	14.0
Sharp, T. R., Goorambat ..	22.6	18.0	22.1	23.3	18.6	24.7	23.5	18.3	25.0	24.3	18.0	17.1	27.6	28.0	19.8	26.7	25.5	14.6	24.9	23.8	18.3
Average Yield per Acre ..	21.0	18.0	22.3	21.5	19.0	22.9	22.8	18.9	23.5	21.2	18.1	17.0	23.6	24.0	18.0	23.2	23.0	18.4	23.2	23.5	16.4
Average Yield. 18 Fields	17.3	13.1	17.7	18.3	13.5	17.7	18.3	13.3	19.3	15.5	13.2	12.9	19.3	19.3	13.5	19.2	18.0	13.0	18.7	19.2	12.5
Increase due to Manures.	4.2	..	4.6	4.8	..	4.2	5.0	..	6.0	2.3	..	..	6.4	5.8	..	5.7	5.0	..	5.7	6.7	..

CRITICISM OF THE RESULTS.

Space will not permit of more than passing reference to the salient features of the experiment, chief of which is the action of different amounts of the phosphatic manures both on the non-subsoiled and subsoiled land.

NON-SUBSOIL.

	Ordinary Superphosphate			Concentrated Superphosphate.			Thomas Phosphate.
	40 lbs.	56 lbs	75 lbs.	16 lbs.	22 lbs.	30 lbs.	58 lbs.
Mallee	13.7	15.4	15.8	14.4	15.0	15.9	12.6
Wimmera	20.5	22.2	22.4	20.5	22.9	24.3	17.6
North Plains	18.0	20.1	19.4	18.7	20 1	21.2	19.1
Average of 19 fields ..	16 8	18.7	18.6	17.3	18.7	19.8	16.0
Average Increase due to Manures ..	3.5	5.4	5.0	3.7	5.5	6.6	2.4

SUBSOIL.

	Ordinary Superphosphate.			Concentrated Superphosphate.			Thomas Phosphate.
	40 lbs.	56 lbs.	75 lbs	16 lbs.	22 lbs	30 lbs.	58 lbs.
Mallee	14.2	14.0	15.1	13.6	14.2	15.4	11.8
Wimmera	17.9	18.2	20.1	17.9	19.6	20.9	14.4
North and North-Eastern Plains	21.0	22.3	21.5	22.9	22.8	23.5	21.2
Average of 18 fields ..	17.3	17.7	18.3	17.7	18.3	19.3	15.5
Increase due to Manures ..	4.2	4.6	4.8	4.2	5.0	6.0	2.3

On the non-subsoiled land, it will be remarked, the most suitable dressing of the ordinary superphosphate is 56 lbs. per acre, while on the subsoiled land, although the differences between light, medium, and heavy dressings are not so marked, the same amount of manure has given the most economical results. Approximately, corresponding amounts of phosphoric acid, supplied in the forms of concentrated superphosphate and Thomas' phosphate, have, particularly in the case of the latter, given less satisfactory returns.

THE ADDITION OF NITROGENOUS MANURES TO THE SUPERPHOSPHATE.

The possibility of the ultimate need of northern soils for nitrogen, in addition to the usual phosphatic dressing, is a matter that has already received attention at the hands of previous experimenters, and the pleasing

fact that up to the present time the demand is not noticeable is clearly borne out by the present results.

SUPERPHOSPHATE ALONE VERSUS SUPERPHOSPHATE AND NITROGENOUS MANURES COMBINED.

NON-SUBSOIL.

	Plot 3. 56 lbs. Superphosphate	Plot 12. 56 lbs. Super: 28 Sulp. of Ammonia.	Plot 13. 56 lbs Super: 30 Nitrate of Soda.	Plot 18. 56 lbs. Super.; 56 lbs. Sulp. of Ammon'a	Plot 19. 56 lbs. Super.; 60 lbs. Nit. Soda.
Mallee	15.4	15.2	15.1	14.4	15.0
Wimmera	22.2	21.9	22.7	20.9	21.8
North and North-Eastern Plains	20.1	21.0	21.5	21.4	21.6
Average of 19 fields ..	18.7	18.8	19.1	18.3	18.9
Increase due to Manures .. .	5.4	5.2	5.7	4.7	5.6

SUBSOIL.

	56 lbs. Ordinary Superphosphate.	56 lbs. Ord Super.; 28 lbs Sulp Am	56 lbs. Ord. Super, 30 lbs. Nit. Soda.	56 lbs Ord. Super.; 56 lbs. Sulp. Am	56 lbs. Ord. Super.; 60 lbs Nit. Soda.
Mallee and Fringe ..	14.0	15.0	14.8	15.0	15.4
Wimmera .. .	18.2	21.5	20.8	20.7	17.6
North and North-Eastern	22.3	23.6	24.0	23.2	23.1
Average of 18 Fields	17.7	19.3	19.3	19.2	18.0
Increase due to Manures	4.6	6.4	5.8	5.7	4.1

On the non-subsoiled land the effect of the additional nitrogen has been to produce slightly more wheat per acre, but still far too little to compensate for the extra expense. On the subsoiled land there is a little better improvement in the yield, but not enough to make the additional nitrogen profitable.

THE ADDITION OF POTASH TO THE OTHER MANURES.

Wheat is a plant that needs potash least of all the plant foods, and what there is used will mostly be found in the straw. The following results show that the northern soils do not respond to this ingredient, and its absence in the manure dressing need give the wheat farmer no concern.

From this comparison it is not difficult to see that the additional potash, either as chloride of sulphate, has not only failed to produce an extra yield, but has in the Mallee and Wimmera even caused a slight falling-off from

the yield of grain produced by the superphosphate alone. Of the two forms of potash the sulphate appears to offer the better possibilities.

NON-SUBSOIL.

	Plot 3 56 lbs. Super	Plot 21. 56 lbs. Super. ; 28 lbs. Sulp. Am. ; 28 lbs. Pot Ch	Plot 22 56 lbs. Super ; 30 lbs. Nit. Soda ; 28 lbs Pot Sulp
Mallee	15.4	13.7	13.9
Wimmera	22.2	21.5	22.4
North and North-Eastern Plains ..	20.1	20.1	20.4
Average of 19 Fields ..	18.7	17.8	18.2
Increase due to Manures .	5.4	4.5	5.7

SUBSOIL.

	56 lbs Super. ; 28 lbs Sulp Am.	56 lbs Super ; 30 lbs Nit. Soda	56 lbs. Super. ; 28 lbs. Sulp Am. ; 28 lbs. Pot. Chloride	56 lbs Super ; 30 lbs. Nit Soda ; 28 lbs Pot. Sulphate
Mallee and Fringe	15.0	14.8	15.0	15.4
Wimmera	21.5	20.8	19.5	20.8
North and North-Eastern Plains	23.6	24.0	23.2	23.5
Average of 18 Fields ..	19.3	19.3	18.7	19.2
Increase due to Manures	6.4	5.8	4.8	6.7

SUMMARY.

The manurial tests involved in the experimental fields necessarily depend on the results of several years before the irregularities caused by soil and season inequalities disappear, and the salient points are confirmed. There is, however, sufficient material in the harvest returns of the first year to make clear to all persons interested in the the experimental work, that the manurial problems of the northern wheat districts are not likely to be adequately solved by a rigid adherence to any conservative method of cultivation or use of manures. It is quite probable that as the experiments mature certain types of soil will group themselves, within limits, to prove the efficiency of special classes and amounts of manure. Special methods of cultivation will probably show better results on some types of soil than on others. In my opinion the Field Branch of the Department of Agriculture will do useful service to the State in ascertaining and collating the various points made manifest from year to year, so that sound principles may be established to which the wheat farmer may look for guidance. Although much has been done in this direction, more remains yet undone.

The results of the first year may be said to point out:—

(*a*) The superiority of superphosphates over other forms of phosphatic manures.

(*b*) That about 56 lbs. per acre has given better yields than lower or higher amounts, and is also the most economical amount to use from the point of view of cost.

(*c*) That up to the present time the northern wheat soils, particularly those of the Mallee and Wimmera, do not show any response to nitrogenous manures. The northern and north-eastern plains show a slight response, but hardly sufficient to cover the extra cost of the manure.

(*d*) That manures containing potash have rather a depressing effect on the yield of grain, and may therefore with safety be left out of consideration for some time to come.

(*e*) That while the average results of subsoiling are somewhat disappointing, a complete explanation can be found in the fact that the deep cultivation was carried out too late in the season to show any but a slight effect in the first year.

(*f*) That the northern and north-eastern districts show a better response to subsoiling than the Mallee and Wimmera, where the rainfall is smaller.

(*g*) That there is an indication that subsoiled land responds better to light application of manures than does land cultivated in the ordinary way.

(*h*) That subsoiled land may be relied on to germinate the seed more rapidly, maintain a more continuous and vigorous growth, and permit of a better formation of heads than non-subsoiled land.

(*i*) That where land has become foul with wild oats, subsoiling appears to assist germination, which in the fallow year enables the land to be thoroughly cleaned.

(*j*) That wheat grown on subsoiled land makes a more vigorous growth of straw, and does not ripen as quickly as on land not so treated.

CONCLUSION.

In concluding this *résumé* of my Report on the Experimental Yields, I desire to again emphasize the need for caution in any consideration of the returns. This should be especially the case with the subsoiling trials, which will require at least another year's test before we can hope to establish any guiding principles for future work. That the farmer cannot contemplate with equanimity any increase in the cost of production I am well aware, but it is worth while noting that improved methods of cultivation will not entail any further cash outlay, and as time progresses the accompanying benefits of healthy weed free crops will reconcile him to the small amount of increased labour.

THE LESSONS OF A DRY SUMMER.

T. Cherry, M.D., M.S.

Throughout the whole of Victoria the last summer has been unusually dry and hot. In the northern districts weather of this kind is more or less expected. Agriculturalists have adapted their methods of farming to meet three or four months without rain, and have made the requisite provision for watering their live stock. Rain, during the months of December

or February, is generally looked upon as a disadvantage in the north, as it starts the growth of the grass, while the young plants a few weeks afterwards are withered up. The consequence of a large proportion of the seeds, which are lying dormant in the ground, thus germinating too early, is a poor growth of herbage during the autumn months. The ordinary routine work, and the expectations of the northern farmer generally provide for a long spell of dry weather. The case, however, is different in the southern districts. Summer fodder crops, grown without irrigation, are required for the progress of every district where the dairying industry has taken a firm hold. Potatoes and other root crops depend for their

1.—CULTIVATING MAIZE AT "THE CURRAGH," DANDENONG. THREE WEEKS FROM SOWING.

success upon obtaining an average amount of moisture during the early part of the summer. This year's experience has therefore been an exceedingly trying one; and it is worth while seeing what can be done in order to guard against a similar experience in the future.

Brains versus Rains.

While the growth of grass in the southern districts has been at a standstill during the summer, farms which have been brought into good working order, and which were not over-stocked, have come through the drought with a fair amount of dry feed for all the live stock. It is the absence of green succulent food, which is being most acutely felt; and the absence of this kind of herbage is very distinctly reflected in the returns from all the chief butter factories of the State. December opened well with an increased output over the corresponding month last year. Towards the middle of January supplies began rapidly to fall off, and during February they fell far below the average for this time of the year. An extension of the season for two months would have meant an extra £200,000 added to the wealth of the State. The potato crop—the one

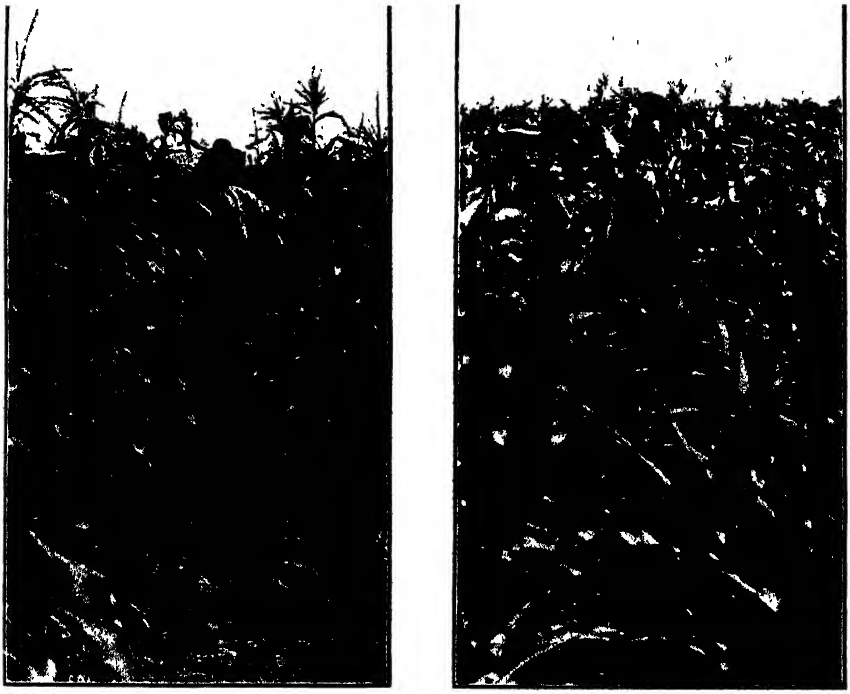
in which most farmers are chiefly interested—has suffered in the same way. The summer fodder crops have been almost complete failures. Yet, as will be seen from our illustrations, a few farmers have managed to grow fairly good fodder crops even without any rain, and it is worth while to inquire into the methods by means of which these results have been accomplished. Taking maize as a type of the summer fodder crops, we find that this year successful crops have been sown on well-prepared land that has been treated with artificial manures, and in most cases with farm-yard manure as well. The crops have been planted in drills, and the space between the drills steadily and regularly worked, so as to maintain the surface in a fine tilth. The secret of the success of these measures

2.—SIX WEEKS FROM SOWING.

is to be attributed to the fact that they are the most effective means of conserving the moisture of the soil. Carefully preparing the ground by ploughing it deeply during the winter, and working it into a fine tilth with the harrows and roller early in the spring, insures a much larger supply of moisture for the roots of the growing plant than is possible in the case of a badly-prepared field. Sowing superphosphate at the rate of about 1 cwt. to the acre, along with seed, insures that the most important part of the food substance for the little plant is readily available. Consequently the young crop makes a vigorous start. Harrowing the surface of the field and, as soon as the plants are a few inches above the ground, beginning a systematic course of cultivation between the rows, keeps the surface in a fine tilth, and prevents evaporation of water, while at the same time it keeps down the growth of weeds, which otherwise would monopolize a considerable proportion of the moisture, instead of allowing the whole of it to be appropriated by the crop. By these means, maize crops have been enabled to hold their own during the months of January and February, and to start forward again in their growth with the rain which fell in the first week of March. In some cases, however, satisfactory crops have been grown which were planted after the previous rain in the beginning of December, and had therefore during the whole of the months of December, January, and February kept growing without

a single drop of water. The legends attached to our illustrations will explain the history of each of these crops. I believe that this season every crop of maize sown broadcast has resulted in failure.

Another way in which the effects of a long drought can be obviated is by the provision of silage in sufficient quantity to carry the dairy herd through the whole of the summer without the assistance of green food. This plan involves the growing of a larger quantity of oats or other cereal in the winter, and using part of it for silage, instead of cutting the whole of it for hay. An up-to-date farmer should combine winter silage with



3. 4.

THE SAME CROP TWELVE WEEKS AFTER SOWING. NO RAIN.

summer crops. Fill the silo first during the month of November with a cereal crop, and feed this to the cows during the dry weather in summer. Grow a crop of maize to fill the silo a second time, and utilize it for winter feed for the dairy herd. This method has been very successfully adopted at Boisdale, where twelve large silos, with an aggregate capacity of about 3,000 tons, have been erected within a couple of miles of the butter factory.

NOTE BY S. S. CAMERON, M.R.C.V.S.

The maize crop, illustrated in Figs. 1, 2, 3, and 4, was sown from 10th to 15th December, 1905. The land was ploughed in the spring, and left fallow to mellow and absorb the rains. After the rains, in early December, it was ploughed 4 inches deep, maize being sown along the bottom of every fourth furrow, giving a distance of 2 feet 6 inches clear

between the rows. The land was then harrowed and rolled. The cultivator was run through between the rows immediately on the plants showing above the ground (Fig. 1), and thereafter every fortnight or three weeks (see Fig. 2). Although no rain fell from 9th December to 9th March, the crop ranged from 5 feet to 7 feet 6 inches high at twelve weeks from sowing, as shown in Figs. 3 and 4. This result was doubtless largely due to the systematic cultivation to which it had been subjected, whereby a 'mulch' of dry loose soil was maintained, and evaporation of moisture thereby prevented.

The Progress of the Silo.

The following notes by R. T. Archer, dairy supervisor, are of interest at the present time:—I recently visited several of the farms on the Boisdale Estate, where silos have been erected, and you will be interested to know that the results this season so far have been very satisfactory. Six of the "share farmers" have two silos side by side. An error was made in the dimensions, which are 24 feet in diameter by 18 feet high, instead of 24 feet high by 18 feet in diameter; the consequence being that too great a surface is exposed at once, and part of the exposed surface moulds

150-ACRE FARMSTEAD, BOISDALE.

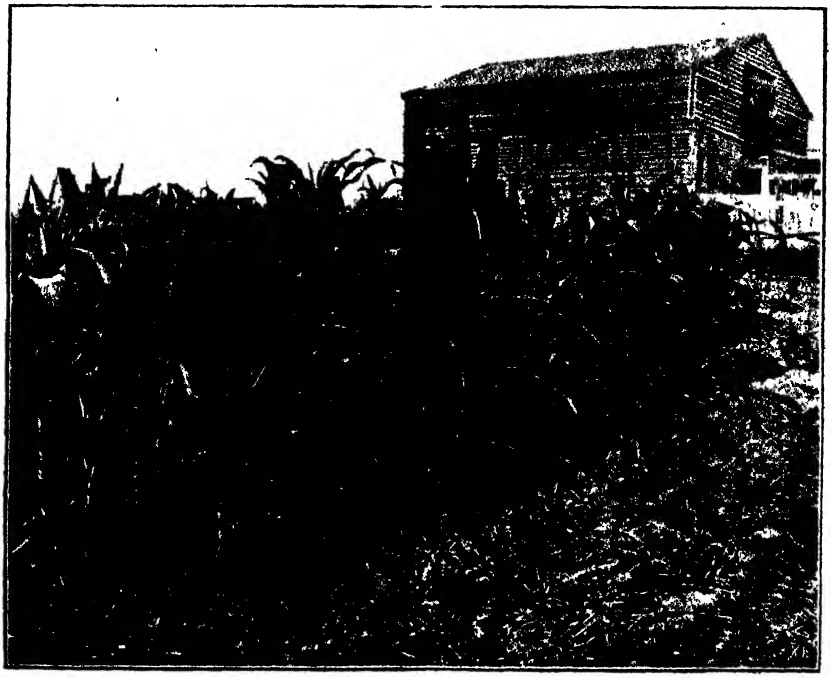
before it can be used. These silos were filled with oats in December, some of the crops being almost dry enough to thresh before being cut owing to unavoidable delay, but when opened this was quite soft and succulent, and proved very satisfactory feed.

On looking through the milk sheets at the factory, it was easy to see who are feeding their cows. The milk supplied to the factory was in most of these cases greater in quantity at the end of February than in December, while those who were not feeding had decreased by half. One farmer (milking 40 cows), the second day after starting feeding silage, delivered 14 gallons more milk, another increased still more, and the cows being kept in full milk during the dry months insures their milking well now the autumn rains have come, when a plentiful supply of grass through the winter is assured.

On my way I saw a stack of maize silage, the owner of which, one of the tenant farmers on the Boisdale Estate, was just carting out a load to the cows. The maize was cut too green on account of caterpillars getting into it. It was bound by a reaper and binder, stacked in the sheaves in a round stack, the sides pared to leave them as even and solid as possible, the result being only about six inches of waste round the outside at the top, and there would be less at the bottom. The top was covered by bags and weighted with posts, and when the bags were removed

there was not an inch of waste on the top. The cows ate the silage greedily. The same practice was adopted last year with the same satisfactory results. The silage came out as green as it went in, and the same right through.

Since visiting Boisdale I was in the Colac District, where the value of the silo is being proved, Mr. Colin Tulloch being one of the first to adopt the use of them. Mr. Tulloch told me that on one of the farms, 416 acres, he milked 140 cows, and received £1,440 for milk from the Colac Butter Factory Company for the year 1905, an average of £10 5s. 8d. per cow, in addition to which £300 resulted from pigs and calves. The silo is credited with being to a considerable extent accountable for these

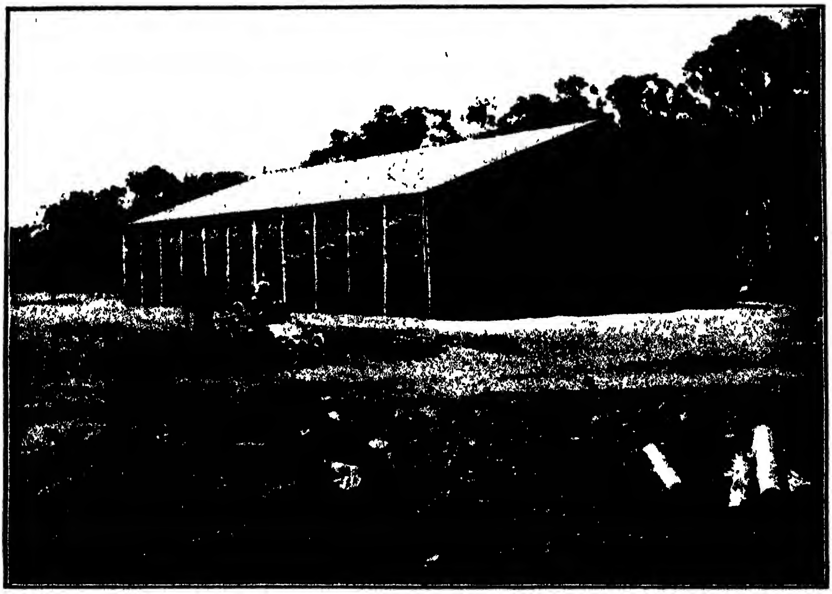


TWO MONTHS' GROWTH. NO RAIN.

good returns. Sometimes it is not easy to obtain the use of a chaff-cutter when the crop is ready for silage, and Mr Webster, of Pirron Yallock, I am told, filled his silo this year with green oat sheaves with satisfactory results. Certainly, if the silo has to be filled with long stuff, it is more conveniently handled in the form of sheaves. If carefully packed, the outsides being kept about three feet higher than the middle, and well trampled, the feeding results are good.

In filling a silo with sheaves, it should be borne in mind that we require to get as much lateral pressure as possible, the fodder to be closely packed as near as possible to the iron lining of the silo, in order to press out the air. To obtain this end it is necessary to adopt a system of stacking the opposite to that in building a stack, laying the sheaves lengthwise against the iron, and packing it all in this fashion so as to bind them as little as possible.

The use of the silo is gradually coming into favour all over the State, and at Nhill several have been built and filled this season, principally with oats, barley, or native grass. The object is to provide succulent food for lambing ewes, just when all the grass is dry. Mr. Dahlenberg has opened and fed a good part of the contents of his silo to cows, and is highly pleased with the results, so much so that he has decided to build several more. Mr. Edwards showed me some of his silage, which, though rather dark in colour, is very sweet and good. Owing to a good rainfall he will not require to use it this season. An impression is prevalent that if silage is not used the season it is made it will be no good, but this is



INSURANCE AGAINST THE NEXT DROUGHT.

Sir Samuel McCaughey has 1,000 tons of lucerne hay at North Yanko as an insurance against drought. After the shed has been filled, a ditch 16 feet wide x 6 feet deep is excavated, and filled with water. This serves to keep mice away, and the tramps cannot get close enough to set fire to the shed.

a mistake. Provided the air is kept away, it will keep good for practically any length of time. Mr. Bond, an old settler in the Nhill district, has been handling silage for ten or eleven years, and when he has not required all the silage in a pit or silo he has filled up again, and that which was left over was quite good when he came to use it another year. Mr. Robinson, of Warracknabeal, told me he has proved the same thing. He won a gold medal, given by Messrs. Cuming, Smith, and Company, for the best silage. The silage was not required for feeding at the time, and he was advised not to open it, but he did, and obtained the medal, then closed it up again until the following season, when it turned out as good as before.

One mistake I notice in filling several of the silos is that the stuff has drawn away from the sides, so letting the air down between the silage and silo, in which case there is considerable waste. This is due to the fact that the middle is kept too full, and the sides not full enough, nor yet

trampled enough. The weight of the silage from the elevator continually falling in the middle is almost sufficient to insure consolidation at that part, and the outside should be kept at least three feet higher than the middle, and well trampled. I also feel sure that it would pay to have planks cut the shape of the silo to lay on the top to exclude the air, and on the top of these planks to place weights, either in the shape of posts, sleepers, bags of sand. or whatever is easiest to handle.

Another mistake is sometimes made in making the silo too great in diameter. This should be proportionate to the number of animals to be fed. King gives the following table as furnishing the best guide as to the diameter of silo, which insures sufficient being removed from the surface daily to prevent any going bad:—

		Feeding Surface.		Inside Diameter.
30 cows	...	150 square feet	...	14 feet.
40 cows	...	200 square feet	...	16 feet
50 cows	...	250 square feet	...	18 feet.
60 cows	...	300 square feet	...	19¾ feet.
70 cows	.	350 square feet	...	21¼ feet.
80 cows	...	400 square feet	...	22¾ feet.
90 cows	...	450 square feet	...	24 feet.
100 cows	...	500 square feet	...	25¼ feet.

I have not met any one yet who has tried silage and is not thoroughly satisfied with the result.

THE ORCHARD.

James Lang, Harcourt.

Gathering in the crop of apples and pears will be the principal work of the orchard during April. In the early districts all varieties should be gathered by the end of the month, but in the late districts they can hang a couple of weeks longer. Be careful in picking fruit intended to be stored, as rough usage in handling soon leads to decay. Apples and pears should be handled as carefully as eggs. Most of the loss by decay in fruit stored can be traced to rough usage in picking; great loss is also occasioned by allowing the fruit to remain too long on the trees. As soon as the fruit matures it commences to drop freely, and if not gathered at once a great portion of the crop falls to the ground. It is therefore better to pick apples and pears intended for keeping a little on the unripe side, and so avoid loss by the fruit dropping. If it is intended to store any of the apples or pears in a cool store, they should be delivered at once. On the whole, the crop of late apples will be very light, and, taking into account the shortage in Tasmania, prices before the end of the winter will rule higher than they have done for several years past.

Manure should be carted out and spread; soil, road scrapings, cleanings from drains, and vegetable refuse of all kinds should be collected and carted into the orchard, as they all help to make valuable manure. The past summer has been unusually dry, especially in the districts surround-

ing Melbourne, where the rainfall during the summer months is generally ample to properly mature the fruit. The past season has, however, been the exception, with the result that the fruit has not grown as large, or matured as well as usual. Consequently orchards that could be irrigated have had a great advantage over those where no water was available. Orchardists who can make provision for conserving water should, therefore, not neglect to construct tanks and dams on their holdings in suitable places, where water can be gathered. The watershed of a dam may be enlarged by constructing storm-water channels to lead into the dam. A good supply of water makes the grower, to a certain extent, independent of the weather, as he can always give the trees a soaking when they require it. It makes a great difference to the fruit when it is grown throughout the season without a check, as it then properly matures, and comes a good colour. The tree is also left in better condition for the next year's crop of fruit.

This is the best time to plant citrus fruits, as the ground being warm and moist they soon root. Shorten back the head when planting, and should the weather be dry, give a good soaking of water.

As the winter is usually a slack time with orchardists, advantage should be taken of the opportunity to look over the fences and effect necessary repairs where required; also clear out drains, so that they will not choke when heavy rain falls.

DISEASES OF FARM ANIMALS.

S. S. Cameron, M.R.C.V.S.

III.—CAUSATION OF DISEASE.

In attempting to combat any given disease the determination of all possible causes of that disease is highly necessary, because successful treatment so largely depends on ability to remove or counteract the cause; and the axiom, "Remove the cause, and the effect shall cease," ascribed to one of the earliest medical writers, although not wholly true, should always be borne in mind.

The causes of disease have in times past been differentiated as *predisposing causes* and *exciting causes;* and, although the line of demarcation between the two cannot be very exactly defined, and has, by recent discoveries and modern methods of research, been made more obscure, the division may still be allowed to serve. It must, however, be understood that many of the conditions which will be indicated and described as predisposing causes may, when brought to bear with sudden force, or when operative over a lengthened period, act as exciting causes of disease.

Predisposing Causes of Disease.

There is some difference between *predisposing causes* of disease and *predisposition* to disease. The former are factors or circumstances, unconnected primarily with the animal, which render it susceptible to contract

disease more readily than it otherwise would, and include such circumstances as climate, locality, food supply, and nature of activities. A predisposition to disease, on the other hand, is a condition possessed by an animal, which renders it vulnerable to the attack of more direct causes of disease. Hereditary weakness, conformation, breed, age, and temperament, are examples of such inherent conditions. But for practical purposes the whole of the circumstances or conditions which tend to increase the liability to disease, whether brought to bear extrinsically or possessed by the animal intrinsically, may be considered together.

CLIMATE.

The climate and meteorological conditions prevailing, not only in different countries, but also during different seasons of the year in the same country, are well known to have an effect on the liability of both animals and man to disease; and this, apart from the much-experienced effect of change of climate (*i.e.*, removal to a different climate), which, in many cases, may be considered as an exciting cause rather than a predisposing one. The widely held notion that the blood becomes thinner after continued sojourn in a hot climate, and is thicker in cold countries is erroneous. That the circulation of the blood may be more sluggish in cold countries than in hot, where the temperature influences function-energies, may be admitted; but that the blood itself is altered in composition, consistence, specific gravity, or fluidity, cannot be scientifically contended.

The circumstances which determine the influence of climate on causation of disease are not well understood, but in recent years light has been thrown in some directions on the subject. Many of those sub-tropical diseases, of which malaria is a type in man, and, say, red-water and South African horse-sickness in animals, are now known to be caused by micro-organisms, which are transmitted to them by the medium of certain insects, such as mosquitos and ticks; so that their occurrence cannot be said to be directly due to climatic influences. Indirectly, however, they are, for the disease-conveying insects only flourish in latitudes where the temperature and atmospheric moisture are such as to favour their development.

The direct effect of *atmospheric temperature* is noticeable as a factor in disease. Apart from disease incidence due to sudden exposure to sun heat, long continued excessive heat induces debility and loss of tone and functional energy, leaving the system more open to attack by disease-producing agents. Conversely, the advent of frost, or excessively cold weather, may cut short outbreaks of microbian disease. On the other hand, long continued exposure to cold undoubtedly tends to lower vital energy, and so predisposes to disease. It has been frequently observed in America that the greatest prevalence and mortality of swine fever occurs in the southern States during the summer, and in the northern States during the winter months; periods when the conditions of temperature and climate are such as to diminish the natural or physiological resistance to disease.

Lung affections are much more prevalent in low-lying situations, with a moist foggy atmosphere, while horses and cattle reared at high altitudes, where the air is more rarefied and dry, are well known to have more hardy disease-resisting constitutions.

LOCALITY.

Certain diseases are observed to be more prevalent in some districts than others, and the increased prevalence can, in a number of instances, be shown to be due to local conditions of soil and weather, or to localized customs of management. Fluke in sheep only prevails on low, marshy, or wet land, suitable for harboring the particular kinds of fresh water snails (physae), which are essential to certain stages in the life of the fluke parasite. In like manner anthrax, rheumatic affections, dysentery, Australian stringhalt, and intestinal parasites, occur mostly on similar country. Foot-rot in sheep is known to be of most frequent occurrence on very wet land, with a clay subsoil, or on dry gravelly country. Sand colic, impaction and paralysis of the bowels in horses are more prevalent in dry sandy localities, where the soil is devoid of surface humus. In the wind and rain-swept gullies and ranges of Gippsland, and other hilly country, febrile diseases, colds, bronchitis, and other lung affections are more severe than in less tempestuous localities, and when contagious or infectious diseases, such as pleuro-pneumonia, swine fever, and strangles, obtain a footing in such districts, their spread is more rapid, and they are more fatal. In Australia the disease of horses know as "nasal disease," which is really a form of osteoporosis, is noticed to be more common in certain localities, as is also goitre and rickets in sheep. Similarly "coast disease" or "cripples" when first of a character to demand attention, was almost confined to the coastal districts.

SOIL EXHAUSTION.

The subject of soil-exhaustion, which is destined to loom largely in connexion with the health and well-being of stock in Australia, may be given brief attention here, for it is, in a great measure, a question of local stock management or agricultural customs. Ever since shortly after the sheep industry got firmly planted throughout Australia, it has been known that certain tracts of country would become, after a shorter or longer lapse of time, "sheep sick," and now, at the end of fourteen or fifteen years from the establishment of the dairying industry some areas, in Victoria at least, are suspected of being "cattle sick." This means that the virgin land, through continuous grazing without manurial or cultural assistance, has become deficient in certain mineral constituents, and that consequently those plants, to the growth of which such mineral matters were essential, have died out, and plants of inferior quality, so far as milk production (or, in the case of sheep, wool production) is concerned, have taken their place. In other words the grazing of one class of animal on the same land for a number of years has almost completely altered the character of the herbage, and while the pasturage may *look* as well as ever, and may *be* as good for grazing another class of animal, its "substance" for the purpose for which it has been used, has vanished. It is estimated that the amount of nitrogen lost to the soil by means of milk removed from the farm averages 45 lbs. per cow per annum; of phosphoric acid and potash from 6 to 9 lbs. each. Taking even good land that will carry one cow to 3 acres, it will be seen that the land is being exhausted at the rate of 15 lb. of nitrogen, and 2 to 3 lbs. of phosphoric acid and potash per acre per annum.

Throughout a period of prolonged drought, this form of soil-exhaustion is more quickly effected. Most of the chemical elements which form the mineral food of plants exist in some form, and in minute quantities, in the air, and may be brought down and supplied to the soil by means of rain. The amount of nitrogen in the form of ammonia that is carried to the soil by rain in country districts during an ordinary season is equivalent to 44 lbs. per acre per annum. In the neighbourhood of towns a greater amount is deposited, and therefore it is not in respect of nitrogen that the soil becomes exhausted. But phosphoric acid, in the form of phosphate of lime, is deposited by rain to the extent of only half a pound per acre per annum; so that the deficiency produced by grazing milking cows is not made up for naturally, and exhaustion of this essential soil constituent goes on at the rate of at least 2 lbs. per acre per annum—an amount equivalent to 10 lbs. of 20 per cent. superphosphate. In dry seasons the adventitious supply of mineral matter, by means of rain, fails, and the deficiency becomes more pronounced.

OVERSTOCKING.

The subject of overstocking may be here briefly adverted to. Apart from the ill effects of continuous grazing just mentioned, and which become much increased when paddocks are overstocked, and apart also from the actual fouling of the herbage by excess of animal discharges, and by "the tramping of many feet," there is the further disadvantage that the good grasses are continuously eaten off as they shoot into growth, and are thus prevented from seeding. In this way the extirpation of much wholesome herbage is hastened. At the same time, useless or actually harmful and noxious plants which are not eaten by stock until the pasture is bare of nutritious grasses, are allowed to seed, until eventually the innutritious herbage predominates, the good grasses having been eaten out. A familiar instance is the gradual usurpation of a pasture by Yorkshire fog grass (*holcus lcnatus*) where this grass has been sown with sweeter grasses; the latter are eaten down continually, while the fog is neglected by stock owing to its harshness, and being a strong grower, it soon takes possession of the pasture. Again, the well-known rib-grass or plantain (*plantago lanceolata*) being much relished by sheep, is a useful grass on sheep country; cattle, however, neglect it, and on cattle runs it quickly becomes a nuisance, not only on account of its spread, but because its flat habit of growth entails great waste of ground surface that could otherwise be utilized by more suitable grasses. Even in times of plenty, the folly of overstocking is not less acute, for then the noxious plants are left still more severely alone to propagate and spread their baneful presence over the pasture, occupying ground that would otherwise accommodate herbage of more nutritious character.

Truly the factors operating towards deterioration of Australian pasture lands are many, and deserve thoughtful attention and action on the part of all concerned. At the risk of being charged with uttering a libel on the common sense of Australian farmers, a protest must be here entered against the suicidal and wasteful practice of burning off seeding grass during bountiful seasons, a practice which is carried out by not a few farmers in some highly-favoured districts. They fear bush fires, and instead of mowing the super-abundance of seeding grass, and turning it into hay or ensilage, as a standby for a time of scarcity, they thoughtlessly resort to the characteristically improvident method of the "fire stick."

ENVIRONMENT.

Unwholesome surroundings may, according to their character and intensity, be such as to excite disease or predispose the animal to an attack. Vitiated atmosphere, as a result of deficient ventilation and perflation, is often a contributory cause of pneumonia, influenza, and other debilitating diseases in stabled animals. So noticeable is the effect of insanitary surroundings on the occurrence and spread of certain diseases, that it has become customary to group them together under the term "filth diseases." By this is meant, not so much that filth in itself will cause these diseases as that their causative germs will find in the unclean surroundings—deposits of dung, manure, and rubbish, stagnant drainage, and the like—ideal conditions for maintaining germ life. As instances of such filth diseases, Tetanus (lockjaw), and influenza in horses, anthrax and abortion in cattle, swine fever and fowl cholera may be mentioned.

Want of cleanly surroundings, especially of working horses, encourage skin diseases, such as mange, eczema. psoriasis (mallanders) crackled heels, mud fever, and grease. "Foul in the foot" of cattle, and foot-rot in sheep are other cases in point.

Want of shelter from cold and rain or *want of clothing*, by preventing the conservation of bodily heat, and *want of shade* from excessive sun heat by retarding radiation of bodily heat, all influence the natural vigour of the animal prejudicially, and so predispose to disease.

SPECIES OR KIND.

Certain diseases are peculiar to certain kinds of animals. Animals of the cattle tribe are alone liable to contract contagious Pleuro-pneumonia, Tick fever, Black leg, Milk fever, and Rinderpest. Strangles. Roaring and Stringhalt are peculiar to horses, and no animal but the dog is ever affected with Distemper.; while Swine fever. Multiple abscess (*lymphadenitis*) and roup are examples of disease, which are confined to pigs, sheep, and fowls respectively. In addition to typhoid fever, syphilis, and appendicitis, a whole host of diseases could be mentioned to which man alone is liable.

Conversely, certain diseases never affect certain kinds of animals. Cattle are completely exempt from Glanders, horses from Foot-and-mouth disease, dogs from liver Fluke, sheep from Purpura, and pigs from Red-water. Donkeys, mules, and goats are peculiarly insusceptible to most of the diseases which ravage the closely allied species—horses and sheep. Thus donkeys seldom suffer from any of the bony affections which are so common in horses, and they, as also goats, are practically immune against Tuberculosis, Anthrax, and like virulent affections of closely-related species. Such diseases, as Foot-and-mouth disease in cattle, Glanders in horses, Rabies in dogs, and Fluke in sheep, while being primarily bovine, equine, canine, and ovine diseases respectively may also affect other species, but in such cases the attack is frequently much modified in type, and milder in form.

Frequently anatomical and physiological differences may determine the incidence of diseases peculiar to a species as in the case of appendicitis in man, Sidebones and Roaring in horses, and Foot-rot in sheep; but

what the influence is which determines the incidence on particular species of animals of the diseases mentioned in the last but one preceding paragraph, is not satisfactorily known. Some light has been thrown on this aspect of the incidence of diseases by recent researches on the subject of immunity whereby it may be speculated that differences in chemical composition and physiological affinities of the component parts of blood cells and blood serum of different animals may account for the susceptibility of some species over others to special diseases. This subject will be more fully discussed under the heading of "Immunity"; but it may here be said that the most hopeful prospects of elucidating the problem lies in those directions to which serum-study leads.

BREED AND TYPE.

Certain types or breeds of horses are markedly susceptible to particular forms of disease. Weed or "shot of grease" (*lymphangitis*), chronic greasy heels and canker of the feet are seldom seen in other than coarse skinned and heavy-legged draught horses. Amongst light horses, cracked heels are usually only met with in coarse-bred and fleshy-heeled specimens, and but seldom in clean-boned fine-skinned horses claiming thorough-bred descent. Navicular disease is rare amongst cart horses, though it is a common enough affection of light-bred animals. Amongst other animals the proneness to milk fever of deep milking types and breeds of cattle may be adduced in this connexion; and in Australia it has been observed that the disease of the lymphatic glands of sheep called multiple abscess, or lymphadenitis, is largely confined to "comebacks." In sheep, it is the lightly-bred merino and other fine-wooled types that more quickly qualify for the "foot rotting" paddock, while the liability of line-bred shorthorns and other pedigree cattle to contract all and sundry constitutional affections is notorious.

CONFORMATION.

Many instances of conformation predisposing to disease could be mentioned, but a few will suffice. Ponies are rarely roarers; it is the long-necked and fine-throated horses that usually develop this disease. On the other hand, ponies and round-barrelled horses of all sorts appear to be prone to broken wind; while those of the opposite build—"herring-gutted" horses—are well-known to be bad doers and liable to attacks of diarrhœa and other forms of indigestion. The association of sickle-hocks with curb, of calf knees with brushing and speedy-cutting, of sloping pasterns with break-down, of upright pasterns with ringbone, fetlock soreness (*arthritis*), and knuckling over, and of narrow upright muley feet with navicular disease, are more than mere coincidence; they are oftentimes cause and effect.

COLOUR.

While the truth of the old saying that "a good horse cannot be a bad colour" may be admitted, there is ample justification for the statement that horses of good colour have more robust constitutions and are less liable

to disease than "off-coloured" ones. By "good" colour is meant that, no matter what shade, it should be distinctive and pronounced. Brown, with tan muzzle, bay with black points, dapple and fleabitten grey, and dark or liver chestnut, are favorite colours, and are characteristic of many great families, amongst which the grey "Snowdens," the brown "Smugglers," and the ticked-chestnut "Sir Hercules" descendants are still famous in the land, not so much for their colour as for the hardy family characteristics which accompany it. Mealy bays or browns with rusty manes and fawn legs; washy chestnuts with yellow mane, tail and leg-feathering; and light mushy roans, are types of bad coloured horses frequently met with, and almost as often found to be soft and skittery, full of funk, and without "bottom."

The absence of pigment in the skin would appear to have *some* influence in determining disease. Hoofs and horns are appendages of the skin, and when white (*i.e.*, unpigmented), they are found to be more brittle, weaker, and more liable to disease than when coloured with pigment. Certain skin eruptions are more pronounced on white cattle and white dogs, and on the white patches of piebald horses; and cracked heels and grease are much more prevalent in white stockinged horses than in those with black points. In the latter case the influence of colour in causing the trouble is undoubtedly subordinate to the irritation produced by the frequent washing and careless drying to which the legs of such horses are subjected; and on the whole the author's experience has not been such as to confirm the view that colour has much to do with the causation of, or liability to, disease in a general way.

The two most striking examples of the association of colour and disease are the melanotic tumors occurring under the tail in the region of the anus in grey horses and brown cattle, and the disease of the womb of white virgin heifers, called "white heifer disease," commonly met with in the hilly parts of Cumberland and the Lake district (England). These diseases are never found in animals of any other colour.

Attention is drawn by De Varigny, in his work on "Experimental Evolution," to the view that in albinos "absence of pigment and sterility are co-related expressions of the same constitutional change," and he also observes that "the cause which induces albinism generally affects the reproductive functions in a marked manner," partial or total sterility being induced.

Metschnikoff's investigations in regard to the function of white blood corpuscles in disease have led him to conclude that depigmentation of man's hair during advancing years is due to the destruction or eating up of the pigment by the white blood cells. If this be true, and if it be argued from it that all absence of pigment is due to invasion and attack of these living cells, it would appear that colour, or more correctly in this connexion, absence of colour or pigment, instead of being a predisposing cause of disease, as is generally held, is rather an effect of disease. This view is supported also by the whitening of the hair, which grows on surfaces previously the seat of saddle-galls and other sores on dark-coloured horses.

(*To be continued.*)

SUPPLEMENTARY LIST OF ARTIFICIAL MANURES forwarded from time to time to the Chemist for Agriculture for Analysis, as required by Section 4 (Sub-sections 1 and 2) of the *Artificial Manures Act Amendment Act* 1905.

SUPPLEMENTARY UNIT VALUES LIST, SEASON 1906.

Description of Manure.	Moisture.	Nitrogen.		Phosphoric Acid.								Potash.		Estimated Total Value of Manure per ton.	Price asked for Manure per ton Delivered at Local Railway Station.	Where Obtainable.
				Water Soluble.		Citrate Soluble.		Insoluble.		Total.						
	Percentage.	Percentage.	Estimated Value in One ton of the Manure.	Percentage.	Estimated Value in One ton of the Manure.	Percentage.	Estimated Value in One ton of the Manure.	Percentage.	Estimated Value in One ton of the Manure.	Percentage.	Estimated Value in One ton of the Manure.	Percentage.	Estimated Value in One ton of the Manure.			
			£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.	£ s. d.	£ s. d.	
Blood Manure ..	27.34	7 01	3 17 1	..	..	..	..	..	..	1.18	0 3 6	1.28	0 7 0	4 7 7	4 10 0	City Council, Melbourne
Superphosphates (Hasell's Jap)	11.88		..	19.42	4 7 4	2.02	0 8 0	..	..	21.44	4 15 4	..	..	4 15 4	4 7 6	A. H. Hasell, Queen-street, Melbourne
Superphosphates ..	2.10	..	..	18.27	4 2 2	3.07	0 12 3	1.41	0 1 4	22.75	4 15 9	..	..	4 15 9	4 10 0	Wischer and Co., Market-street, Melbourne
Superphosphates (Special)	4.06	..	..	21.87	4 18 4	1.50	0 6 0	0.38	0 0 4	23.75	5 4 8	..	..	5 4 8	5 0 0	" "
Superphosphates ..	12.12	..	..	18.13	4 1 7	1.98	0 7 11	0.29	0 0 3	20.40	4 9 9	..	..	4 9 9	4 5 0	W. P. Shaw, "Olderfleet, Melbourne
Guano	..	..	..	..	..	..	..	..	..	17.12	2 11 4	..	..	2 11 4	2 15 0	Wm. Holden, St. Leonards
Bonedust and Superphosphate	12.28	1.50	0 14 3	6.12	1 7 6	8.26	1 13 0	2.82	0 8 5	17.20	3 8 11	..	..	4 3 2	5 5 0	J. A. Dundas, Dynon-road, Melbourne
Grass Manure, Standard (Flag Brand)	7.62	0.98	0 9 3	12.88	2 17 11	3.58	0 14 3	0.56	0 1 8	17.02	3 13 10	0.94	0 5 2	4 8 3	5 0 0	Renard Fertilizer Co., Melbourne
Potato Manure, Standard (Flag Brand)	6.62	0.95	0 9 0	9.01	2 0 6	3.81	0 15 2	0.86	0 2 6	13.68	2 18 2	2.62	0 13 1	4 0 3	6 0 0	" "

Supplementary Unit Values List, Season 1906—*continued.*

Description of Manure.	Moisture. Percentage.	Nitrogen. Percentage.	Nitrogen. Estimated Value in One ton of the Manure.	Phosphoric Acid. Percentage.	Phosphoric Acid. Estimated Value in One ton of the Manure.	Mechanical Condition. Percentage of Fine Bone.	Mechanical Condition. Percentage of Coarse Bone.	Mechanical Condition. Nitrogen. Percentage in Fine Bone.	Mechanical Condition. Nitrogen. Percentage in Coarse Bone.	Mechanical Condition. Phosphoric Acid. Percentage in Fine Bone.	Mechanical Condition. Phosphoric Acid. Percentage in Coarse Bone.	Estimated total Value of Manure per ton.	Price asked for Manure per ton Delivered at Local Railway Station.	Where Obtainable.
			£ s. d.		£ s. d.							£ s. d.	£ s. d.	
Bonedust	6.16	3.10	1 11 1	19.00	3 4 6	37.00	63.00	1.14	1.96	5.75	13.85	4 15 7	5 10 0	J. A. Dundas, Dynon-road, Melbourne
"	10.76	2.40	1 3 10	16.25	2 16 11	57.47	42.53	0.73	1.67	8.24	8.01	4 0 9	5 0 0	G. Gardiner, Geelong
"	8.00	4.21	2 1 4	23.01	3 14 2	25.94	74.06	0.96	3.25	5.27	17.74	5 15 6	5 10 0	A. Day, Bendigo

Supplementary List showing Results of Analyses of Samples of Artificial Manures Collected throughout the State under the Provisions of the Artificial Manures Act 1905.

Description of Manure.	Manufacturer or Importer	Nitrogen. Found	Nitrogen. Guaranteed.	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Mechanical Condition. Fine. Found.	Mechanical Condition. Fine. Guaranteed.	Mechanical Condition. Coarse. Found.	Mechanical Condition. Coarse. Guaranteed.	Estimated Value per Ton.
										£ s. d.
Bonedust, Special ..	Cuming, Smith, and Co., Melbourne ..	4.49	5.00	19.66	17.00	50.03	40.00	49.97	60.00	5 14 7
Bonedust	J. Cockbill, Melbourne	3.57	3.50	20.15	18.25	44.84	31.43	55.16	68.57	5 5 2
"	Kensington Manufacturing Co., Kensington	3.54	3.50	19.55	19.52	23.18	38.88	76.82	61.12	4 17 7
"	H. J. Feore and Co., Richmond ..	2.77	2.45	17.22	16.28	63.48	26.98	36.52	73.02	4 10 4
"	J. A. Dundas, Footscray	2.92	3.49	16.37	18.31	69.30	34.29	30.70	65.71	3 19 11
"	" " "	2.12	3.49	14.84	18.31	64.74	34.29	35.26	65.71	3 13 10

Supplementary List showing Results of Analyses of Samples of Artificial Manures—*continued.*

Description of Manure.	Manufacturer or Importer	Nitrogen.		Phosphoric Acid.								Potash.		Estimated Value per Ton.
		Found.	Guaranteed.	Water Soluble.		Citrate Soluble		Insoluble.		Total.		Found	Guaranteed.	
				Found	Guaranteed.	Found.	Guaranteed.	Found	Guaranteed	Found	Guaranteed			£ s. d.
Superphosphate, Florida ..	Cuming, Smith, and Co., Melbourne	..	..	17.84	18.00	2.11	1.50	.56	1.50	20.51	21.00		..	4 9 2
Sulphate of Ammonia ..	,, ,, ,, ,,	19.68	20.00	..	..	..	..	..	..	..	..	..	..	14 2 0
Nitrate of Soda ..	,, ,, ,, ,,	16.27	15.50	..	..	..	..	..	..	..	..	..	..	12 12 0
Thomas Phosphate ..	,, ,, ,, ,,	..	..	..	..	13.29	12.00	2.92	3.75	16.21	15.75	..	..	3 1 11
Potato Manure ..	,, ,, ,, ,,	1.28	1.06	7.66	8.21	5.67	3.63	7.43	5.53	20.76	17.37	6.26	5.20	6 6 11
Bonedust and Superphosphates	,, ,, ,, ,,	1.72	1.50	6.50	7.50	8.12	5.00	5.46	8.50	20.08	21.00	..	..	4 15 8
Orchard Manure ..	,, ,, ,, ,,	1.50	1.55	14.45	14.40	2.14	1.20	..	1.20	16.59	16.80	6.10	6.00	6 2 4
Superphosphate, No. 1 ..	Mt. Lyell M. and R. Coy., Melbourne	..	..	20.52	18.50	1.22	1.25	.96	1.00	22.70	20.75	..	..	4 18 1
,, ,, ..	,, ,, ,, ,,	..	..	20.65	18.50	.59	1.25	1.28	1.00	22.52	20.75		..	4 16 6
,, ,, ..	,, ,, ,, ,,	..	..	20.29	18.50	.93	1.25	1.33	1.00	22.55	20.75	..	..	4 16 2
Superphosphate, Special ..	Wischer and Co., Melbourne..	..	..	21.56	20.00	.13	1.00	1.11	1.00	22.80	22.00		.	4 18 7
,, ,, ..	,, ,, ,, ..	..	..	20.73	20.00	1.33	1.00	.39	1.00	22.45	22.00	.	.	4 18 10
,, ,, ..	,, ,, ,, ..	..	..	17.20	18.00	.95	1.50	2.02	1.50	20.15	21.00	.	..	4 3 0
Vegetable Manure ..	Renard Fertilizer Coy., Melbourne	1.86	1.25	6.66	9.30	5.91	3.40	1.95	..	14.52	12.70	2.65	2.50	4 12 10
Bonedust and Superphosphates	J. A. Dundas, Footscray ..	1.36	2.06	3.03	8.79	7.74	6.38	3.69	4.53	14.37	19.70	..	..	3 9 2
Blood Manure	,, ,, ,, ..	9.90	7.15	..	..	..	..	..	..	..	..	..	..	5 8 11
Pea Manure	Sheaf Brand Manure Coy., Melbourne	..	..	10.59	13.00	2.98	1.00	..	..	13.57	14.00	2.50	2.40	3 13 2
Superphosphate, Anchor Brand, No. 1	Colonial Manures Coy., Melbourne	..	..	16.80	17.50	2.16	1.00	..	..	18.99	18.50	..	..	4 4 2
Star Phosphate, Anchor Brand	,, ,, ,, ,,	..	..	..	..	13.55	14.00	7.25	3.00	20.80	17.00	..	..	3 15 11
Superphosphate, Anchor Brand	,, ,, ,, ,,	..	..	16.87	17.50	1.50	1.00	.	..	18.37	18.50	..	.	4 1 10
Superphosphate	J. Cockbill, Post Office-place, Melbourne	..	..	15.87	17.11	2.87	1.90	..	..	18.74	19.01	..	.	4 2 9
Superphosphate, Standard Flag Brand	Renard Fertilizer Coy., Melbourne	..	..	16.02	17.00	3.73	1.50	.25	.50	20.00	19.00	..	..	4 7 3

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THE MALLEE FRONTAGE OF THE MURRAY RIVER.

An Undeveloped Province of Victoria.

A. S. Kenyon, C.E.

RIVER MURRAY AT MILDURA.

From Nyah, a small township on the Murray River, some eighteen miles below Swan Hill, to the South Australian border, a distance of 450 miles by the course of the river, the Victorian bank is almost entirely without inhabitants. The one striking exception to this condition of loneliness and abandon is the irrigation colony of Mildura. Brought into being under the most glowing anticipations, nurtured in toil and trouble—particularly the latter—it has slowly achieved a large measure of success,

despite all adverse criticisms. The few miles of the frontage occupied —an area of less than 30,000 acres in all—support an industrious and prosperous population of 4,000 souls. This desirable result has been brought about by the intelligent use of water, otherwise flowing past wasted to the sea. There is nothing at all exceptional about Mildura itself. As a matter of fact, with the knowledge now acquired, many places, superior both in soil and in location, could be selected along the river. All along the lands adjoining the main stream is the best of soil lying parched and

RED CLIFFS, NEAR MILDURA (120-FT. HIGH).

unproductive, awaiting the application of the water which Nature has thoughtfully brought in abundance to the spot, for man to draw upon.

THE FRONTAGE LANDS ABOVE MILDURA.

With the river frontage itself must also be considered the immediately adjoining interior lands of the Mallee country. As will be shown in the course of this article, the interior lands are, for the purposes of profitable and permanent settlement, practically inseparable from the frontage. There are, in the frontage lands of the River Murray, two main classes, the river flats and the higher ground—the Mallee itself. The character of the country, both in regard to the Mallee and the flats, but particularly the latter, differs so much above and below Mildura, or rather the junction of the Darling River at Wentworth near by, that it becomes necessary to treat these parts separately. The frontage above Mildura will be first considered.

River Flats.

The river flats comprise three different classes of soil and growth. The first, the red gum flats, intersected by creeks and billabongs, and studded with lagoons of a more or less permanent character, grows little but red

gum. The timber, though of large dimensions, is poor, and not fitted for use in engineering structures, though good enough for sleepers and house-building. The butts are generally covered with rough, black, persistent bark, a bad sign for the saw-miller. From many of them have been stripped sheets of bark to form canoes for the blackfellow, whose oven-mounds adjoining the high-flood mark are numerous. Wherever the red gum grows, it is safe to assert that annual flooding, and flooding for considerable periods is the rule. After prolonged flooding, a water grass

BOX FLATS, NARRUNG, WITH OLD MAN SALTBUSH.

comes up, which is an excellent fodder for sheep. It is, however, an exception. Apart from the lignum bushes, there is little feed of value. Pigs should do well, and in this direction, there appears a chance of profitably using these flats. Reclamation by levee works is not to be thought of; the consequent reduction in the flood-carrying section of the stream would tend to dangerously raise the level of floods. The locking of the river for the improvement of navigation will cause a considerable proportion of these flats to be submerged. The next division is the lower box flats, which are considerably higher than the red gum flats. They are of much older formation, and, although formerly traversed by abandoned courses of the river, the resulting billabongs have been silted up, mostly beyond recognition, by the wide spreading of the silt-laden flood waters. The lower box flats are subject to light and partial flooding only, save at very high stages of the river. When free from submergence for some years, a good season brings out a splendid growth of grass and edible bushes. Besides the ordinary native grasses, canary grass, wild oats, creeping saltbush, and many other varieties may be noted. The timber is almost wholly box, an occasional native willow being seen. The box, though on these flats of large size, is of little use except for fencing posts and firewood. The higher box flats form the third class. They are flooded, but rarely—at intervals of 20 to 30 years. The timber is smaller, of stunted, twisted habit, and very slow-growing. It is of service for

firewood only. Occasional pines and an odd clump of Mallee are seen. The grass is better and more abundant. The old man saltbush (*atriplex nummularium*) occurs abundantly in places where it has not been eaten out completely by over-stocking. None of the other perennial varieties of saltbush is to be found except in the interior, although the creeping saltbush (*atriplex semibaccatum*) is fairly plentiful. Both the higher and lower box flats are suitable for grazing and unsuited for cultivation. The somewhat heavy nature of the soil precludes successful working under the light rainfalls of the district without irrigation, while the fine soils of the Mallee alongside are more than sufficient for all the irrigation possible from the river, and at a far greater profit than the flats. The timber

CLIFFS ON THE MURRAY.

now on them with what may be grown in the future, will, however, become useful as a fuel supply for the numerous pumping plants which will eventually spring up along the river.

The Mallee Country.

The Mallee country also embraces three classes; the frontage lands of good, generally excellent, quality; the inferior interior lands—porcupine country; and the medium to good interior lands. The frontage varies from very narrow—a few chains only in width—to several miles across. It rises abruptly from the river or the billabongs, in cliffs 100 feet and

over in height, or slopes up gently from horse-shoe shaped flats until it reaches a level of 40 to 60 feet above the river. The vegetation sup-

OPEN MALLEE COUNTRY.

ported by it is mostly Mallee (*Eucalyptus dumosa, incrassata, Behriana,* &c.) of an open character, although at times fairly dense. There also

PINE GLADES.

occur in large forests, or scattered throughout, the Murray pine (*callitris cupressiformis*), belar, buloke (*casuarina glauca*), quandong, both bitter and

sweet (*santalum acuminatum*), needle bush (*hakea leucoptera*), myall, willow, cabbage, and many other trees and shrubs. The clearing of the denser parts, particularly the belar forests, will be a matter of some expense, cutting down and burning being worth up to 30s. per acre; but the rich soil thus made available will amply repay the outlay. Interspersed at frequent intervals are finely-grassed plains, or open spaces, up to several hundred acres in extent, which, dotted with shrub-like trees — trimmed off neatly on the lower edges by the stock—and occasional pines, with here and there a finely-foliaged red gum, present a sylvan aspect.

PORCUPINE GRASS RIDGES.

quite unlike the popular idea of the Mallee desert. In spring it would be a difficult task to find in any other part of the State such pleasant scenery.

The Interior Lands.

Behind the frontage fringe of good country lie the interior lands. Over a considerable portion there grows the porcupine or spinifex grass, a fairly reliable index to poor country. Fortunately the porcupine grass is mainly confined to the low sandy ridges which traverse the country from east to west, while the flats between are of good red soil, suitable for profitable wheat-growing. Phosphatic manures will be required, and systematic cultivation and fallowing. The absence of suitable catchments, and comparatively inferior soil render this area hardly fitted for settlement on the ordinary lines; but in conjunction with the more fertile lands of the Mallee fringe, it is capable of being utilized with success. There is also in the interior a considerable extent of medium, and in parts very good agricultural land.

THE NOWINGI COUNTRY.

At Nowingi, on the Mildura railway line, and extending westward from there to the 142nd meridian, is a large tract of country presenting several peculiar features. Large salt lakes, some as much as twenty miles in length—lakes in name only, having a thin skin of glistening white salt in the summer, and in the winter a film of water over their beds — occur thickly. On some, less salt than others, the beadbush (a species of rhagodia) grows, and occasionally the saltbush has taken hold. The saltbush occurring here is the "sheep saltbush." It also is found constantly around the margin of all the salt lakes

IN THE NOWINGI COUNTRY.

for a width of a few chains, and it grows largely amongst the Mallee bushes wherever they occur. Some large plains, which are probably, judging from the evidence of their margins, and by the occurrence of what were formerly islands, the beds of old salt lakes, are covered with the saltbush, to the exclusion of all other vegetation. A notable instance is the Raak Plain, of about 40,000 acres. On the high ground separating the lakes, magnificent belar forests appear with much sandalwood (*santalum persicarium*), pine, and other trees and shrubs. Considerable grassy plains occur with large clumps of tobacco bush, and immense fields of white and yellow everlastings. On the whole, very little mallee is to be met with. The fatal drawback to the settlement of the Nowingi country is the water supply. Good or fair catchments are fairly numerous; but good holding ground for the excavation of tanks is absent. Salt water is reached in a few feet at any good sites for tanks. It is proposed to work these lands in connexion with the frontage country at Carwarp—country of the usual frontage type, except that it is not so elevated above the river level as usual.

THE HATTAH AND OTHER FRESH-WATER LAKES.

Another characteristic feature of the interior country is also the occurrence of lakes, but this time fresh—when they have water in them. The

THE HATTAH LAKES—LAKE MOURNPOOL.

flood waters of the Murray, making their way over the flats, or through the billabongs and creeks, fill large depressions or lakes situated several

DRIFTING SAND.—LAKE MOURNPOOL.

miles back from the frontage. The Hattah lakes form an important series, there being about ten large lakes, a great number of small ones, and numerous box swamps. The good land immediately adjoining the lakes is

not of as great extent as usual, while it is of such a loose sandy nature without any intermixture of clay to cause coherence that, except under irrigation, the breaking up of its surface by cultivation will not be advisable. As far as can be judged in the absence of levels, the whole series of these lakes can be filled or topped up annually during the high river periods, without the expenditure of any great sums of money. In some of the larger lakes could be stored considerable volumes of water, while from others the water could be excluded, and their beds used for irrigation. The beds are composed of a considerable depth of black crumbly clayey soil, containing a fair amount of humus, and highly suitable for intense culture.

Making permanent the supplies in the lakes would increase the amount of frontage to water for settlement purposes, and at the same time bring the interior lands nearer water. Near Narrung, and about two and a half miles back from the river, across extensive higher box flats, is a lake of

A MOB OF STEERS AT BUMBANG.

about 500 acres in area, and capable, apparently, of holding 16 to 20 feet of water. Water gets in at long intervals, the last occasion being about twelve years back. It is surrounded by high ridges, clothed with pines. When seen last in November, a small flock of sheep and a large mob of emu were the sole inhabitants. The land immediately adjoining the lake—the same is the case for all lakes, whether salt or fresh—is of excellent quality, particularly on the northern and eastern shores. Small irrigation settlements could be established on any lake, filled regularly from the surplus or flood waters of the Murray, and after locking, this would be easy of achievement. They would be on a much smaller scale than Mildura; but would score on account of better soil and lower lifts for the pumped water.

BUMBANG.

The country lying in the embrace of the river, as it makes its great sweep from the Murrumbidgee junction round by Euston to the Coreena Bend, is known as Bumbang. The whole of it, amounting to over 80,000

acres, is of first-class quality, and could be cut up into comparatively small areas for wheat-growing alone. The vegetation is similar to the best of the frontage fringe, and the whole is well-grassed, large plains alternating with open country. Rolling downs impart a pleasing appearance to the scene. The height above summer level of the river varies from 60 to 100 feet. It is suitable for fattening lambs, as the autumn and spring grasses rarely fail, even with the low rainfall, the light, sandy soils responding readily to light rains. The pastoral lessee has some 3,000 acres under wheat, and is clearing a large area for further cropping, evidencing a considerable amount of faith in the profits of cereal growing up there. On the eastern boundary is another large lake—Lake Powell, or, as it is locally termed, Belcher's Lake. This might also be readily converted into a permanent storage, and form the nucleus of settlement. Probably no greater stretch than Bumbang of first-class land can be found in the State. All that is wanting to render it as valuable as any, is water. Failing that, and water for the irrigation of the whole area is too much to expect, much may be produced from it by up-to-date methods of cultivation and cropping.

DISEASES OF FARM ANIMALS.

S. S. Cameron, M.R.C.V.S.

III.—CAUSATION OF DISEASE.

(*Continued from Page* 253.)

TEMPERAMENT.

Except that nervous and skittish horses are more liable to accidents, and frequently exhibit a loss of appetite, purging, or other slight derangement after a fright, or abuse, or other excitement, it may be doubted whether temperament has as much influence on the causation of disease as is usually supposed. The idea that activity of the general or systemic circulation, which is said to be associated with high breeding and the sanguine temperament, predisposes to inflammatory diseases and congestions is not supported by experience in practice. In point of fact, congestions are more common in horses of languid disposition and circulation, and inflammation will more often supervene on the attack of a common cause in a fat, ill-conditioned horse with sluggish circulation than in a trained muscular horse, with heart and circulatory organs up to concert pitch. On the other hand, the tendency to dropsical swelling and puffiness of the extremities in coarse-bred horses, and which is put down to lymphatic temperament and sluggish circulation, is more reasonably accounted for by the anatomical features of the tissues concerned. The cow and sheep are considered to have a dull, lymphatic temperament, yet except during the occurrence of actual disease, these animals are singularly free from "filling" and puffiness of the legs, even when kept stall-tied for a lengthy time.

Pain may be felt more acutely by a horse of a highly nervous temperament than by a crossbred "slug"; but it by no means follows that the suffering of pain is made more pronouncedly manifest. In point of fact, the reverse is more often the case; and to operators of extended experience, the first violent plunge of the thoroughbred at the first cut of the scalpel, followed by the grim setting of the teeth and the dogged bearing of pain without further fuss, are evidences of "pluck" on which could almost be based an estimation of the animal's capacity for "seeing it out" at the end of a sternly-contested race. This capacity to bear pain without murmur is a feature in the high-bred one in marked contrast to the squealing and groaning, wriggling, and sweating and general cowardly behaviour which is kept up continuously by the underbred cur while under the knife.

SEX.

It is obvious that the anatomical variation of the sexes will account for the occurrence of disease in one sex, which cannot occur in the other; but apart from this it has been observed that in some few diseases to which both sexes are subject, notably roaring in horses and bladder affections, that the proportion of affected males is measurably greater than females.

The increased functional activity of the generative organs of females during pregnancy and the lactation period induces tendency to disease, and the alteration of the nutritive equilibrium which occurs at such times is sometimes responsible for grave derangement of the system. Mares "in season" are frequently subject to attacks of hysteria, and are not seldom the victims of accident.

AGE.

So important a factor is age in regard to the incidence of disease that the term "age period," has come to have considerable significance in the differential description of diseases. Thus the age period of tuberculosis in man is that of adolescence, or early maturity (between 18 and 25); while in cattle, tuberculosis is primarily a disease of advanced maturity or old age. Again, measles, acute rheumatism and cancer are associated in men with particular age periods, as are, in animals, white scour, distemper, rickets, black leg, and strangles with youth; milk fever, roaring, navicular disease, sidebones, and splints, with maturity or middle age; and indigestion, intestinal calculi, blindness, tumours, and degenerations with old age. Lambs and calves are liable to invasion of intestinal and lung worms, and other parasites which older animals of the species resist; and the period of dentition is frequently accompanied, especially in dogs, by serious nervous and digestive derangements amounting to disease. Decay, and unevenness of wear and growth of the teeth are accompaniments of old age in animals, and these, in turn, by preventing thorough and necessary mastication of the food, give rise to debility and various manifestations of indigestion, such as colic, diarrhœa and unthriftiness.

In considering age as a factor in disease, it is well to regard it always relatively. As some men are young at 60, and others old at 40, so with horses; the vim, energy, and "cockiness" of some old stagers over 20 should, if there was consciousness of the emotion, put to shame many a five-year-old.

PREVIOUS DISEASE.

Many instances can be cited of previous disease, whether general or local, predisposing to an attack of either the same disease or some other. After recovering from laryngitis, bronchitis, pneumonia, pleurisy or other disease of inflammatory type, the patient is always more liable to a second attack from an even less potent exciting cause. The disease leaves behind it the proverbial "weak spot," and it is often a long time before this predisposition to subsequent attack disappears. Weed, or "shot of grease" (*lymphangitis*) has a particular proneness to recur on the slightest provocation after a first attack.

Some diseases almost invariably occur as a sequel to others of a different type; to wit, chorea, or St Vitus' dance, following on distemper in dogs, rheumatic affections of joints following on influenza, roaring succeeding strangles, and so on. Complications during the course of a disease are often simply the result of the action of a cause which, without the "weakening" produced by the already pre-existing disease, would be inoperative.

DIATHESIS.

This is a term used to indicate a constitutional peculiarity of individual animals, or of species of animals, in which liability to contract certain forms of disease is marked. In such animals or species, causes which would be trivial and ineffective in other animals or species, result in the development of serious conditions of disease. The rheumatic and tubercular diathesis are the most familiar examples in individual animals of this peculiar constitutional condition. In an animal possessing the rheumatic diathesis, a slight cold or chill will precipitate an acute attack of rheumatism, while in the tubercular diathesis, although the bacillus of tuberculosis must be present before the disease can develop, the animal seems to become an easy victim to its attack. Diathesis is often confounded with heredity, but the distinction will be seen when it is said that the tubercular diathesis is hereditary, while tuberculosis (the disease itself) is, with rare exceptions, not so; the disease is not inherited, but the tendency to it is.

As an illustration of diathesis occurring throughout a species, what has been termed the "ossific diathesis" of horses, may be mentioned. No other species of animal exhibits such a tendency to the formation of bony deposits and growths—splints, spavins, ringbones, and the like bony disease growths are practically peculiar to the horse tribe.

Some animals possess a diathesis, or idiosyncrasy, with regard to certain medicines; for example, an ordinary dose of, say, aloes, will produce most violent purging and bowel spasms in odd horses. In fact, it may be said generally that horses in Australia are much more intolerant of that drug than they are in Britain, and it is consequently used much more sparingly in veterinary practice here. Another familiar example of this unusual susceptibility to the action of a drug is the violent irritation and pain produced when turpentine is applied to the skin of the horse, whereas in the case of man the application has to be accompanied by pretty smart friction to produce even a glow or an uncomfortable degree of warmth.

HEREDITY.

The vulnerability to tubercle, which may be inherited, has already been referred to, and as with this disease so with roaring, broken wind, spavin curb, navicular disease, ringbone, cataract, and the majority of diseases that have hitherto been classed as hereditary, it is the *tendency to the disease* which is inherited, and not the disease itself.[1] That is to say, animals with such tendencies will develop such diseases on the incidence of slight exciting causes, whereas in other animals such causes would be ineffective. If such exciting causes are withheld, the hereditarily-disposed animal may escape the affection altogether. This is strikingly illustrated in the case of roarers, whose offspring, when bred and reared in a dry hot climate like that of India and Australia, seldom develop the disease, whereas in the damp chilly climate of the British Isles, such offspring almost inevitably succumb to the tendency, and develop into roarers. It will be inferred from this that roarers are rare in Australia, and, comparatively speaking, that is so. Similarly, navicular disease rarely develops in Australia in horses which would be considered in England hereditarily predisposed, because the exciting cause in the shape of hard macadamized road does not exist, except in the neighbourhood of large towns. When an inherited tendency to disease has not manifested itself by the development of that disease in a given animal, it often happens that in succeeding generations, on the occurrence of influences favorable to the development of the disease, it will be produced. It is frequently observed in regard to such diseases as ringbone, navicular disease, and cataract (blindness) in horses that the disease does not occur in the progeny until it reaches the age at which the parent became affected. In the case of the two former affections, this may simply mean that similar conditions of life experienced during the same age period, may produce similar results, but such an argument can scarcely apply in the case of cataract.

In-breeding tends to accentuate characteristics, and may occasionally be practised with advantage, but intimate knowledge of its laws is necessary to prevent deterioration of constitution. *Consanguinity*, which results from in-breeding, and by which is meant nearness of blood relationship, emphasizes the tendency to development of hereditary defects, so that where disease exists in a family, close breeding should be rigidly avoided. The bringing together of strains which each possess unsuitable characteristics or

[1]It may be well to qualify this statement somewhat in the case of tuberculosis, in spite of the now widely-held view that this disease is never inherited, for cases have been recorded of calves being born with the disease, and the following case investigated, and not previously recorded, is here given, to excite discussion among those who hold that such cases are congenital, and not inherited :—In a duck with generalized tuberculosis, the wall of the oviduct was the seat of extensive tuberculous invasion, some of the tubercules discharging into the oviduct, in which was impacted a concreted mass of egg substance. This consisted of a central yolky portion, enveloped by alternate and incomplete layers of hardened albumen and shell, evidently developed successively during the lengthened stay of the impacted mass. Imprisoned between the layers and between the innermost of them and the yolk tubercle bacilli were found, which had evidently been discharged from the tuberculous wall of the duct. It would appear from this that a naturally developed egg might easily become impregnated during its passage along the oviduct by bacilli from its walls, and the question arises whether the tuberculosis which would doubtless develop in the chick after hatching should be described as having been acquired or as having been transmitted hereditarily.—S.S.C.

a tendency to contract the same disease is very unwise for the same reason —the likelihood of such characteristics or tendencies being accentuated in the progeny.

Cross breeding will at first favour increase of vigour, but much harm may ensue through want of knowledge or appreciation of the effects of prepotency in sire or dam, or of influence of an adverse character arising from injudicious mating.

When disease is actually transmitted from parent to offspring before birth—as may occasionally be the case with strangles, anthrax, and some few other diseases—and is present in the offspring at or before birth, it is termed *congenital* disease, that is, a disease acquired from the parent by the offspring after conception, and during intra-uterine life.[1]

Defects of Conformation, which predispose to disease, are most surely transmitted to the progeny, especially by prepotent sires or dams; and while it is not necessary to risk an action for damages by actually naming sires that have proved useless on this account, most observers of stud racers will, without stretching their memories unduly, be able to call to mind many instances in which a horse of faulty conformation has managed to battle through a course of training and win races, and thereby gain a reputation, but whose progeny have been practically worthless, through inheritance of the defect which made their sire "difficult to train." One of the most conspicuous instances in recent years, is that of a placed horse in a *fin de siecle* Melbourne Cup, which, magnificently formed in all other respects, possessed pronouncedly upright pasterns. This defect caused his premature retirement from the turf, and though given excellent chances at the stud, his progeny have, almost without exception, been "tarred with the same brush," and unable, for that reason, to stand training.

FOOD.

On one hand excess of food, either in quantity or quality, may predispose an animal to indigestion, colic, congestion of the liver, and like derangements of the digestive functions, and on the other hand lack of food or starvation, by inducing debility, will lay the system open to the successful attack of germs and other direct causes of disease. Unsuitability of food is equally likely to pave the way for disease. Feeding on musty hay, for example, for a lengthened period will, if it does not actually cause the disease, at all events precipitate an attack of asthma or broken wind. New hay, and partially fermented chopped foods are notorious as causes of colic, "hoven," and other bowel disturbances.

In this country those derangements of the digestive tract, caused oftentimes by unsuitable or defective food, of which chronic indigestion and broken wind are a type, are comparatively rare. This is due indirectly

[1] It has recently become the fashion to say that all such diseases are "acquired," *i.e.*, acquired *in utero*, and not hereditary. To all intents and purposes, however, I think such cases come under the ordinarily understood interpretation of the term "hereditary"; and if that is conceded I fail to see the difference between a disease acquired in the womb before birth, and that acquired from the parent immediately after birth; so that, in the case of tuberculosis, which is doubtless not rarely acquired by the newly-born offspring from the mother through the milk, I am personally of opinion that it may, for practical purposes, and in the absence of artificial conditioning, be considered to be hereditary.—S.S.C.

to the influence of climate. Throughout Australia, fodder of all kinds is usually harvested under circumstances that, with the exercise of ordinary care, preclude the likelihood of its being damaged, or rendered unwholesome to a disease exciting degree, as is often the case with the grass and cereal fodder crops in England during the broken-weather hay time and harvest seasons, so commonly experienced there. While the food of animals is thus mostly sound, it is of a character so monotonous as to account for a variation in type of many disorders. Seed-grass hay, so largely used throughout England as a staple food is, on account of the seasons, very difficult to grow as forage in Australia, and hay consisting solely of half-ripened cereals (oats or wheat) is the staple food all the year round, and takes the place of the naturally mixed diet which grass hay itself affords.

While it may be at once admitted that horses do not require that their food should be varied to the extent requisite in man or other omnivorous animals, all experience points to the advisability of an occasional change of food. A diet which is suitable in the depth of winter is not calculated to be health-maintaining during the excessive heat of summer, yet the wheaten or oaten hay or chaff ration is seldom altered; and if supplemented, it is by the addition of oats or bran by which the monotony is not varied. The want of variety is rarely relieved by the giving of carrots, or other alterative food, and it is very exceptional for barley, maize, beans, peas, or linseed foods to be used. At certain seasons green stuff may be given, but, consisting, as it usually does, of young oats, it is no change, such as an occasional feed of green vetches, peas, beans, or prairie grass would be.

WATER.

What has been written regarding food in excess or lack, may apply also to water, although animals will rarely take an excess of water if they are allowed continual access to it. On many extensive grazing areas throughout Australia, and particularly during drought periods, the only available supply of water is that contained in natural water-holes, or artificial tanks. Such stagnant water is always highly charged with vegetable growth, and often with the urine and excrement of animals which have unrestricted access to it. In hot weather it is likely to become putrid and filthy, and it forms an ideal developing medium for legions of animal parasites—fluke, tapeworms, and the like. Hence the extraordinary prevalence of intestinal and other parasites in Australian domestic animals, particularly dogs and sheep; and hence also the fact that, excepting Iceland only, hydatid disease in man is more prevalent than in any other country in the world.

Contaminated water, by virtue of the organic matters and microbes it contains, is often an exciting cause of disease. Indeed, there are grounds for believing that the influence of contaminated water in the propagation of various epizootic diseases, has not been given sufficient weight. From the known method of spread of typhoid fever in man, it may be very well argued that animal diseases of similar type are also frequently "waterborne."

CONDITION AND TONE.

High condition, using the term in the sense of over fatness, predisposes to lung congestions, as seen in fat pigs and cattle when over driven, and

to that derangement of the digestive organs so commonly occurring in stall-fattened oxen. Absence of tone, by which is meant a lack of vigour, and flabbiness, of the heart and muscular system together with feebleness of digestion and assimilation, may be set down as predisposing to congestions and dropsies, and anæmia, and want of what is known as "physiological resistance," and is often responsible for determining an attack of contagious or infectious disease.

HABIT.

Instances of "habit" in animals predisposing to, or inducing, disease, are by no means so common as is generally supposed. The erroneously termed "bone chewing habit," so usual amongst cattle in certain districts and certain seasons, is evidence of a depraved appetite—an effect of disease rather than a cause; and in the same category may be included the "wind-sucking," "crib-biting," "weaving," and "stamping" habits of stabled horses. Amongst racing entires, the habit of spurious seminal ejaculation or self-abuse results in decline of their racing powers and general physical vigour, but beyond an abnormal lassitude and lethargy, it is not usual for actual diseases to be induced. The habit of licking themselves is responsible for the formation of hair balls in the stomachs of cattle; and in horses the injury resulting in capped elbow is often attributable to the awkward position in which the animal habitually lies.

EXERCISE.

It is the want of exercise rather than its excess that predisposes to disease attacks. Excessive exercise acts as an exciting cause. Such diseases as lymphangitis (weed or shot of grease), azoturea, congestion, and inflammation of the lungs and laminitis (founder) are likely to occur after a long period of abstention from exercise has been suddenly terminated.

NATURE OF WORK.

The activities of the animal, and the direction in which its energies are expended, have considerable influence on the occurrence of disease. Broadly speaking, it may be said that the greater the amount of functional activity in a part the greater the liability to disease. One of the best illustrations of this statement is afforded by the modern dairy cow, which has had the milking capacity developed to an extraordinary degree with the result that the udder is now-a-days the frequent seat of many diseases of an inflammatory nature which, prior to the inordinate increase of its lacteal activities, were comparatively rare.

The "'ammer, 'ammer, 'ammer on the 'ard 'ighway" is notoriously responsible for the occurrence of laminitis, or founder of the feet, and of splints in roadsters, and sidebones in draught horses. Sprains generally —in the racehorse sprains of the superior and inferior suspensory ligaments and back (flexor) tendons, and curbs, and in the draught horse sprain of the inferior check ligament below the knee—are predisposed to by the great strain liable to be imposed on the parts by the strenuous exertion during a race in the one case or a heavy up-hill pull in the

other. Hunters are particularly prone to congestion of the lungs and spasm of the diaphragm, on account of their being frequently subject to conditions inducing distress; and as an instance of the nature of the work predisposing to accident, the dislocations of the toe bones which are of frequent happening in coursing dogs may be cited.

Exciting Causes of Disease.

As previously indicated, it is intended to consider under this head as exciting causes of disease *per se*, only such agencies as between which and the disease produced there is direct evidence of cause and effect relationship. Such agencies may be broadly classified as *vital* (microbes and parasites), *physiological* (medicinal agents and poisons), *mechanical* (violence), and *chemical* (poisons and toxins).

VITAL EXCITING CAUSES.

Living germs, or micro organisms, or microbes, are now known to be the exciting cause of many diseases which, without their presence, cannot occur. When the subject of microbic disease is being dealt with in its special place, the mode of operation of germs in the production of many diseases will be indicated, and it will suffice here to say that it is extremely probable that all contagious, infectious, and transmissible diseases are caused by germs, although, as yet, the actual demonstration that such is the case in regard to some of the diseases which most markedly belong to one or other of these classes, is not possible. Foot and mouth disease, rinderpest, cow-pox, sheep-pox, rabies, and epizootic abortion are notable examples of diseases which are essentially communicable, but of which the actual causative germs have not, up to the present, been discovered. Until recently, pleuro-pneumonia of cattle, distemper of dogs, pneumonia and strangles of horses could be placed in the same category, the casual organisms having been demonstrated only within the last year or two. On the other hand, the microbic origin of anthrax, blackleg (symptomatic anthrax), tuberculosis, lockjaw (tetanus), glanders, and swine fever respectively, has been beyond dispute for a number of years.

There are one or two diseases of which milk fever, azoturea, and rheumatism are perhaps the most prominent examples, about which our knowledge, though not at all limited, is so uncertain that there is scarcely justification at present for classing them as germ diseases.

Parasites, both external and internal, are disease-causing vital agencies, which are essentially direct or exciting. Lice in itch or pruritis, the *dermatodectes* and *symbiotes* parasites in mange and the tinea fungus in ringworm are ecto-parasites whose disease-producing action can be readily observed. The "sturdy" parasite (*cœnuris cerebralis*) in the brain of sheep, causing "gid" or "staggers"; the fluke parasite (*distomum hepaticum*) in the liver of sheep and young cattle, causing diarrhœa and emaciation; the lung worm (*strongylus filaria*) in the bronchial tubes of lambs and calves, causing bronchitis; tapeworms (*tænia cœnurus*) in the intestines of dogs, causing diarrhœa and indigestion; and hydatid cysts throughout the organs of various animals may be instanced as types of internal or endo-parasites which excite disease.

PHYSIOLOGICAL EXCITING CAUSES.

Closely allied to vital or living exciting causes of disease are those which excite or depress the various physiological functions of the body. Amongst such causes may be included the actions of medicinal agents in inducing what may be termed artificial disease—purgatives setting up diarrhœa, astringents inducing constipation, vesicants (blisters) causing congestion and inflammation, stimulants producing delirium, narcotics effecting coma (unconsciousness), and so on. Some poisons act physiologically—prussic acid, strychnine, opium, aconite, alcohol, and many other poisons produce their lethal effects by stimulating beyond endurance or depressing beyond recovery the physiological activities of nerve tissue. Snake poisoning in its most ordinary manifestation is a striking example o· death being produced by physiological depression.

MECHANICAL EXCITING CAUSES.

Violence, when directly exerted, causes fractures, sprains, bruises, abrasions, wounds, and other injuries. Indirect violence, such as occurs from concussion during fast work on hard roads excites splints, spavin, sidebones, ringbones, and laminitis.

Foreign bodies may mechanically obstruct orifices and tubes, and so cause disease, as, for example, in choking, in constipation, and impaction from intestinal calculi, in uræmic poisoning from blocking of the urinary passages with gravel or stone, in gangrene of the lungs and other organs from blocking of the blood vessels by means of blood clots formed *in situ* (thrombi), or particles of blood clot, tissue or pus conveyed from a distance (emboli).

Pressure.—Tumours pressing on the brain, and cysts and inflammatory exudates pressing on the spinal cord or nerve trunks, causing epilepsy and paralysis; liver abscess occluding, by compression, the biliary duct, and causing jaundice; and the undue bearing of the shoe on the angles of the heels, causing corns in horses, are all examples illustrating pressure as a mechanical cause of disease.

CHEMICAL EXCITING CAUSES.

Many poisons produce their effects by chemical action on the tissues. For example, the mineral acids, caustic alkalies, arsenic, tartar emetic, nitrate of silver (lunar caustic), and other caustics; also astringents such as tannin, catechu, and sulphate of copper (bluestone).

Certain waste matters from the body produced as a result of tissue change, which are excreted by the lungs, liver, kidneys, and skin under normal circumstances, commonly exert their deleterious effects chemically (when retained in the system from any cause). Thus, retention of urea produces azoturea and uræmic poisoning; retention of bile gives rise to jaundice; and when carbonic acid gas is not eliminated, unconsciousness and delirium result.

The various toxins which are produced by the action of living germs during the progress of such diseases as anthrax, septicæmia, and tetanus, are also presumed to act chemically; and it is by the elaboration and action of these toxins, rather than to the other activities of the germs, that the evil effects of germ diseases are due.

SOIL BACTERIA.

A. A. Brown, M.B., B.S.

No. 4.

Fixation of Nitrogen by Nitrifying Bacteria and by Chemical Processes.

In article No. 3, which appeared in the *Journal* for November, 1905, it was stated that means existed by which plants could avail themselves of the free nitrogen present in the atmosphere, and transform it into compounds suitable for plant food, and in this article we will commence a discussion on the many facts associated with this profound problem; and we will endeavour to furnish, along with other appropriate information, a general idea of the intricate workings of bacteria in the soil. It may at once be stated that it is now definitely known that certain plants, by a wonderful property with which they are endowed, can make use of the free nitrogen of the atmosphere as a food. This wonderful property of taking hold of free nitrogen and elaborating it into nitrogenous compounds is inherent in leguminous plants, and, in the present state of knowledge, leguminous plants are not to be regarded as by any means the least in importance amongst all the important factors in the realm of vital forces.

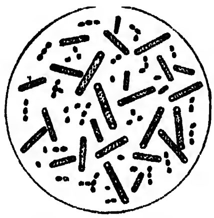
It had long agitated scientific minds as to whether atmospheric nitrogen could be utilized directly by plants as food. For a long time the balance of opinion was against the idea, and it is easy enough nowadays to comprehend the great difficulties that beset the paths of early investigators who tried to solve the profound problem. Berthelôt, in 1876, first definitely proved that some plants had the power of fixing free nitrogen, and he also maintained that some *soils*, apart altogether from plant life, had the power of taking up nitrogen and converting it into nitrates. This property, we now know, is possessed by certain bacteria which reside in the soil, and which are capable of exciting *nitrification*.

In the soil, under natural conditions, *nitrifying* bacteria are perpetually at work and constantly adding nitrates to it. If a soil is allowed *rest*, its quantity of nitrates will be spontaneously increased, so *rest* and *fallow* are factors in increasing the amount of nitrates in the soil. The nitrogen for the production of these nitrates is, in part, derived from the atmosphere, and certain bacteria in the soil have the power of seizing hold of free nitrogen and of converting it into nitrogen compounds, which eventually are transformed into nitrates. Nitrogen, then, can be combined in the soil by certain bacteria without the intervention of plant life; but, although this power of fixing free nitrogen is not distributed over a wide range of germs, nevertheless its importance in Nature must not be under-estimated. It probably is of far greater moment than we at the present day can ever hope to form a proper appreciation of.

The passage of a flash of lightning through the air causes a combination of the oxygen and nitrogen present therein, and the nitrates thus formed are ultimately washed into the soil by the rains. Then, again, by the agency of electricity, nitrogen can be fixed, and it is possible that the near

future may see great developments in the direction of the production of artificial nitrates for manurial purposes by the use of this force. Nitrogen from the air can also be fixed by being compelled to pass over carbide of calcium at a high temperature, and this process of *fixing* nitrogen can be conducted on a scale to produce nitrates at a reasonable cost, and in large quantities.

I have cultivated from the soil of Melbourne a bacterium identical, morphologically, with the bacillus ellenbachiensis, an organism said to



BACILLUS ELLENBACHIENSIS FROM SOIL OF MELBOURNE (HIGHLY MAGNIFIED).

have the power of *fixing* free nitrogen under certain circumstances. It is however, quite probable that all soils contain bacteria that can *fix* free nitrogen in an insoluble form, and, to obtain the maximum effect from them, all that is needed is proper cultivation and treatment of the land. Professor Eschweiler, of Hanover, and Dr. Woltereck, of London and New York, claim to have discovered a new process of *collecting* and *fixing* free nitrogen from the atmosphere, not directly through the roots of plants, but by taking advantage of changes associated with the combustion of peat. The process consists in passing a current of air mixed with steam over a mass of peat maintained in a state of slow combustion. As a result, ammonia is formed by the chemical combination of hydrogen obtained from the steam, with part of the nitrogen originally present in the peat and part of the nitrogen contained in the air passing over it. Then the current of mixed gases is passed through sulphuric acid, and sulphate of ammonia is formed. It is said that five tons of ammonium sulphate can be obtained from 100 tons of peat. As time goes on, yet more effective and simpler artificial processes may be alighted on for combining the free nitrogen of the atmosphere in a form suitable for plant food.

If large quantities of nitrogen can be fixed by any or all of the various methods to which attention has been drawn, then no alarm need be felt as to the source from which future supplies of nitrates will be obtained to meet the world's requirements.

FIXATION OF NITROGEN BY LEGUMINOUS PLANTS.

There are certain plants (*leguminous plants*) working in conjunction with certain bacteria (*nitrogen-fixing bacteria*) that have the power of seizing hold of the free nitrogen of the atmosphere and of combining it in their tissues, and thus increasing the amount of combined nitrogen in the soil. We have already pointed out that plants can obtain the carbon they require for their nourishment from the carbonic acid gas of the

atmosphere, and, at first glance, it might appear that plants might also be able to obtain their nitrogen from the free supply of this gas in the atmosphere in much the same simple fashion but careful experiments, however, have conclusively shown that the general run of plants cannot obtain their nitrogen in any way analogous to the way in which they obtain their carbon. There is, however, one order of plants—the *Leguminosæ*—that is definitely known to possess the power of absorbing the free nitrogen of the atmosphere in a remarkable fashion. If we pulled up, in its entirety, one of these leguminous plants, and examined its roots, we should find them covered with little lumps, or nodules. These nodules are easily seen on the roots, and, when examined microscopically, they are found to be full of bacteria. These bacteria have the power of taking hold of free nitrogen, and of *fixing* it in the nodules. For convenience, these bacteria are called nitrogen-fixing bacteria. With but few exceptions, no other plants, except leguminous plants, have the property of being able to obtain their nitrogen direct from the air. All other plants, without exceptions, can only avail themselves of nitrogen as a food when it exists in the form of nitrate.

All leguminous plants, by the agency of the nitrogen-fixing bacteria, are able to assimilate free nitrogen, and manufacture it into nitrogenous or proteid material, just as all classes of plants are able to obtain carbon from the carbonic acid gas of the atmosphere, and build it up into highly complex organic compounds. The discovery of these organisms in the tubercles on the rootlets of leguminous plants was made by Hellriegel and Wilfarth. The absolute necessity for the presence of these organisms in the soil intended to grow leguminous crops was shown by Nobbe. He sterilized soil, containing all necessary plant food constituents, by heating it to a high temperature, and then he planted in it seeds of legumes. Sterile water was used to water the plants. The seeds germinated, the plants appeared above ground, but were stunted, and remained stunted throughout their period of growth. On examining the rootlets of these plants no nodules were found. In other portions of the same soil, which were not sterilized, control plants showed a luxuriant growth, with abundant formation of tubercles.

Again, seeds of a leguminous plant sown in ordinary soil, containing all necessary plant foods, except nitrogen, and watered with pure water, will exhibit marked peculiarities. The seeds will germinate just as if a store of nitrogenous foods existed in the soil, and, at the outset of existence, the young plant develops just as well in the absence of nitrogen from the soil as in its presence. It feeds at first upon the foods stored up in the cotyledons, or seed-leaves. As soon, however, as this store of food is exhausted, the plant receives a temporary set-back to its development, and, judging by the appearance it assumes, one would think that it was about to perish, and that it could not again recover its vitality. The cause of the sickly condition is to be attributed to the absence of nitrogen, for all other foods are present. The condition is one of *nitrogen-hunger*. Any plant—apart from a few exceptions, to be mentioned later—but a legume, if grown under conditions such as those detailed, would never recover from this condition of *nitrogen-hunger*. A legume, however, will be observed to remain sickly from a few days to three weeks, according to circumstances, and will then quickly recover. It will rapidly become green, and start to grow vigorously. When mature, it may be just as

large, and contain just as much nitrogen, and possess as many tubercles, as one provided with a nitrogen fertilizer from the start. These experiments demonstrate that leguminous plants can grow in a soil destitute of nitrogen; but it must not be concluded that it is not necessary for a soil to possess nitrates to promote the growth of leguminous crops. On the contrary, the presence of nitrates assists the leguminous crops to tide over the *nitrogen-hunger* stage; but, as soon as that stage is passed, they no longer require nitrogenous manures, for they then can readily procure all the nitrogen they require from the atmosphere. In practice, the fact is taken advantage of by farmers, who plant soils poor in nitrogen with leguminous crops. When the crops are mature they are ploughed into the ground. The ploughing in by the farmer of green crops constitutes the practice known as *green-manuring*, and reference will be made to it later.

It is highly probable that the original sources of the world's stock of combined nitrogen that is now being exploited are to be traced to the activity of the bacteria found in the nodules of leguminous plants.

ROOT-TUBERCLES OR NODULES.

On examining a leguminous plant that is carefully pulled up from the ground in its entirety, there is observed on its roots and rootlets a number of little tubercles, or nodules, or swellings. Their size varies much, and varies also according to the variety of plant examined. Some may be as small as a pin's head, others as large as a pea. These nodules had for centuries attracted attention, and were long thought to be of the nature of a disease. It was, however, a puzzle to observers to find that those plants that had the most nodules were the most vigorous, and those that did not, for some reason or other, develop tubercles, or that only developed them in moderate amount, were poor in comparison with those that had them largely developed. This fact, no doubt, to them, exploded the notion of their being a disease, but their function was not then understood.

A series of experiments in connexion with their formation led to very interesting results being obtained. It was found that tubercles would not form if the plants were grown in sterilized soil and watered with sterilized water. Killing the bacteria in the soil had a profound influence on the development of the plant, and, indeed, unless sufficient nitrogenous food was added to meet the plant's requirements, it would perish. In sterile soil, even when nitrogenous food is added in sufficient amount, plants do not vigorously thrive. They are stunted in their growth, and form no nodules. Now, leguminous plants grown in sterile soil quite destitute of nitrogenous food, but watered by water with which ordinary soil has been mixed, but from which all solid particles have been filtered, display peculiar characteristics. Legumes grown in sterile soil containing no nitrogenous material, but watered with infusions of ordinary soil, from which all solid matters have been removed, eventually become vigorous plants, but a marked peculiarity in the course of their growth is observed. The seeds, when sown in such soil, readily sprout, and the little plants grow splendidly until all the nitrogen stored up in them is exhausted, and then they become sickly. The leaves turn yellow, and show an appearance of drying up. This sickly condition is caused by lack of nitrogen, and Cohn speaks of this stage in the development of the plant as the *nitrogen-hunger*

stage. After enduring nitrogen-hunger for a few days, the plants recover their vitality, become green again, and start growing vigorously, and, when mature, are large-sized plants, yielding good crops.

Now, control plants, grown in sterile soil, destitute of nitrogenous material, and watered with pure water, sprouted just as readily as those watered with soil infusions; but, when all the nitrogen in the seeds was used up they became sickly, and from this condition they never recovered, but died away.

It has already been stated that, upon examining the roots of those plants that were grown in sterile soil which was watered with soil infusions, numerous nodules were found; whereas on the roots of plants grown in sterile soil, containing all necessary plant food constituents, but watered with pure water, no nodules were found on the roots. The facts detailed indicate that in the soil infusion there was an agent which favoured the development of tubercles, and thus led to the fixation of nitrogen with vigorous development of the plant. Leguminous plants possess the property of being able to fix nitrogen in their tissues, and it is this property which is inherent in them that enables them to tide over the ***nitrogen-hunger*** stage. The bacteria that exist in the nodules can in some way transform the free nitrogen into nitrogenous material, and thus lead to the plant being supplied with this indispensable food.

ROOT-TUBERCLE BACTERIA.

The facts that have been detailed concerning the production of tubercles led observers to assume that living organisms were the agents effecting the processes. Microscopic examination of the tubercles led to the discovery in them of small bodies of various shapes and sizes, but early investigators thought that these bodies produced a disease of the plant tissues, thus causing the development of the nodules. Nowadays their function has been determined, and, instead of being regarded as of a baneful nature, they are incorporated amongst the propitious organisms on the globe. Bacteriologists, after the discovery of the germs in the nodules, set about isolating them and growing them in special culture media. By adopting certain laboratory methods, the bacteria can be isolated and grown pure. In gelatine-plate cultures, they form small mucinous colonies, but do not liquefy gelatine. They are strictly aerobic, and demand full supplies of oxygen to promote growth.

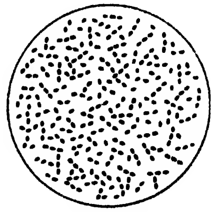
That the bacteria produce the tubercles seen on the rootlets has been definitely proved by experiments. As already related, leguminous plants were grown in sterile soil, possessing no nitrogenous material, but watered with soil infusions that naturally contained the organisms, with the result that numerous tubercles formed on the roots, and the plants developed; whereas plants grown in similar soil, but watered with pure water, developed no tubercles, and perished.

In germinating peas, kept moist and warm without being planted in the soil, nodules can be made to appear on the rootlets, if such are wounded by being pricked with a needle, and then dipped into mineral solutions containing pure cultures of the germs.

In the nodules the bacteria may display many grotesque forms. Some are γ, and some τ shaped, some are branched, some are like the Greek λ, some are rods, and some are cocci. Sometimes long thread-like masses filled with bacteria are seen. A drawing by the Government Printer of

the germs found in the nodules of the broad-bean plant shows various forms, and some indication of their appearance can be obtained from the preparation, which was made in my laboratory. A drawing of the bacteria, derived from the nodule of the broad-bean plant, but cultivated in specially-prepared gelatine before being mounted, reveals an almost uniform type of organism, thus offering a contrast to the form of the germ as it exists naturally in the nodules.

BACTERIA FOUND IN NODULES OF BROAD-BEAN PLANT (HIGHLY MAGNIFIED).



BACTERIA CULTIVATED IN GELATINE FROM NODULES OF BROAD-BEAN PLANT (HIGHLY MAGNIFIED).

The nodule bacteria, no doubt, exist in almost all soils, and make their way into the roots through the delicate root-hairs at a very early stage of the plant's growth. Once inside the roots, they find favorable conditions for development, and they, no doubt, stimulate the tissues, so that an increased growth of the roots occurs. The tubercles are really growths produced by the activity of the germs, and, although it may be quite easy to demonstrate that the germs produce the tubercles, it is not so easy to show that they can cause the plants to assimilate free nitrogen from the atmosphere. It is not definitely known whether the nitrogen is absorbed through the leaves or through the roots, but the balance of opinion inclines to the assumption that it is absorbed in the soil water through the roots. The nitrogen, then, does not directly come from the air, but from nitrogen dissolved in the soil water, the ultimate source of which, however, is the atmosphere. Leguminous plants are an essential factor in the *fixation* of nitrogen, but the plants cannot *fix* the nitrogen in the absence of the bacteria, nor can the bacteria vigorously thrive in the absence of the plant. The association of the leguminous plant with the nitrogen-fixing bacteria, *Bacillus radicicola*, is the condition essential for the *fixation* of nitrogen. The association of two different organisms working together for mutual benefit is known under the name of *symbiosis*. Whether it is the plant or the bacillus that fixes the nitrogen, or whether the two must work concurrently to produce the result, is not clear. Some investigators claim that the bacillus fixes the nitrogen, and that the roots are simply appropriate media for their development. This is quite possible, for, as already pointed out, certain bacteria can fix free nitrogen independently of leguminous plants, so that it is possible, indeed, that the bacillus can fix free nitrogen independently of leguminous crops, and, if that circumstance should prove to be trustworthy, then cereal crops might be benefited by an application of cultures of the germs to the soil. In a plot on which I carried out experiments, a maize crop, and subsequently an oat crop, appeared to have benefited materially by the application to the soil of pure cultures of nitrogen-fixing bacteria derived from the pea, broad bean, and clover. The control plots, to which no germs

were added, did not show such vigorous growth, but extended experiments will require to be made before definite announcements can be made, and it is only by experimentation that trustworthy results can be obtained.

Again, some investigators think that the leguminous plants fix the nitrogen through the agency of their leaves and roots, the germs in the roots merely serving as agents to stimulate the normal functions of the plants. Those who maintain this view declare that many other plants besides the legumes can fix small amounts of nitrogen. They say that algæ, oats, mustard, and other plants can assimilate free nitrogen. Even if such plants can *fix* nitrogen, the quantity they assimilate is extremely small as compared with that fixed by legumes. Ordinary plants, or even leguminous plants, in the absence of bacteria, have but little power in *fixing* a quantity of nitrogen appreciable to the chemist. It has been remarked that certain soil bacteria can *fix* free nitrogen in an insoluble form, and it has been suggested that tubercle bacteria avail themselves of these compounds and render them soluble for the needs of leguminous plants. It is impossible to say which theory is correct, but the fact that the *Bacillus radicicola* and the leguminous plant working together can *fix*, in large amounts, free nitrogen is indubitable. Under natural conditions, the bacteria in the nodules, along with the protoplasm of the nodules themselves, are incessantly joining forces with the nitrogen circulating in the soil to promote its conversion into organic material. It must not be overlooked that, although leguminous plants can, in the presence of the bacteria, fix free nitrogen even in the absence of nitrogenous compounds, yet they prefer taking their nitrogen from nitrogen compounds in the soil, if such compounds exist in sufficient quantity. If, however, the soil does not furnish them with sufficient combined nitrogen for their growth, then they fall back upon the atmosphere for their supplies. If a soil is well supplied with nitrogenous material, there is little or no *fixation* of free nitrogen by leguminous crops; but, if the soil is poor in nitrogen compounds, then the leguminous crops draw upon the atmosphere for the nitrogen food they require. The *fixation* of nitrogen by leguminous plants and nodule bacteria working in unison occurs only when the soil is deficient in nitrogenous plant foods, and, where such deficiency exists, legumes and bacteria, conjointly acting, restore its fertility.

(To be continued.)

GARDEN NOTES.

J. Cronin, Inspector Vegetation Diseases Acts.

The Dahlia.

The Dahlia is a hardy, herbaceous, tuberous-rooting, perennial plant, the whole of the original species being natives of the sandy meadows of Mexico. The dahlia was first introduced into Spain and England in 1789. The original plants imported into England were lost, but seeds were introduced five years later, from which plants were raised and

cultivated. The credit of improving the original types, the flowers of which were single or semi-double, is due to Continental gardeners, who, during the period of the Napoleonic wars, had raised many varieties of superior character. Count Leliur, of St. Cloud, in France, was one of the most successful hybridists, raising a number of fine double-flowered varieties of varying shades of colour. After the peace of 1815, the finest Continental varieties were introduced into England, and gardeners there began the work of improvement which has continued to the present. For many years, raisers of new varieties aimed at the production solely of show or fancy dahlias, with rounded petals building into flowers of globular form, and discarded any that varied from that standard. The introduction of a garden variety ("Jaurezii") from Mexico, which produced scarlet flowers resembling certain species of cacti in form, was the beginning of the evolution of the present cactus type. There are still a few gardeners who

CACTUS, "MRS. J. CRONIN." SCARLET, NARROW PETALLED AND INCURVING.

CACTUS, "J. H. JACKSON." MAROON CRIMSON.

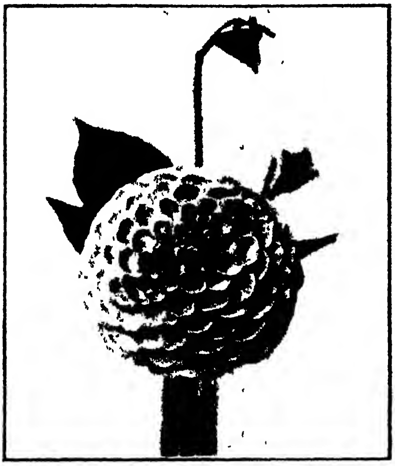
aim to raise new varieties of show dahlias, but most of the raisers at the present time attempt to improve the cactus dahlia, the flowers of which are stellate in shape, with long, narrow, rolled petals regularly arranged, and of more or less incurved form. The original cactus type is altogether superseded, and so are many of the finest varieties known five years ago. A number of these are now classified as decorative dahlias, the petals being broader than in the later types. Other classes are Bedding and Pompon dahlias, really branching and diminutive show kinds, and the single varieties. The tree dahlia (*Dahlia imperialis*) is grown occasionally, but rarely blooms where early frosts occur.

PROPAGATION.

CUTTINGS—DIVISIONS—SEEDS.

Most of the plants purchased from nurserymen are produced from cuttings taken from plants that have been forced into growth in hot-houses

during September and October. The cuttings are taken from the plants when about 3 inches long, and inserted in small pots filled with sandy soil. The pots are placed on a heated tank, where the cuttings root in two or three weeks, afterwards being re-potted and gradually hardened preparatory to being planted out in season. Division of the crowns is usually the method employed by gardeners who have no hot-house. The roots are divided from the stems downwards, care being taken that there is a growth bud on each division. There is no need to divide the crowns until the buds are well developed. One tuber with a portion of the stem, carrying one or two buds, is sufficient, but tubers only are useless. Seed should be sown in the open ground, or in pans or boxes, early in October. Light soil is most suitable. If slugs or snails are prevalent, they will destroy the young plants, unless prevented. The plants should be shifted to their flowering quarters when about 3 inches high. Fair room should



A TYPICAL SHOW VARIETY. "MRS. OCOCK."

POMPON, "ISABEL."

be allowed them, for they will grow into large plants during the season, and will bloom during March and April.

SOIL AND CULTURE.

Dahlias thrive best in a soil fairly friable and rich in plant food. Some of the finest exhibition blooms shown in Melbourne are grown in light sandy soils. Strong, fairly open, loams will produce equally fine blooms, often more correct in type. Good drainage is an absolute necessity. The beds should be prepared some months before planting time. A good dressing of cow or stable manure (or a mixture of each), half rotted, should be worked deeply into the soil, and occasionally turned over. In the last digging before planting, a dressing of bonedust or superphosphate should be worked into the beds. When choosing a site for a dahlia bed, a position sheltered from the heavy winds should be selected. Exclusion of light and sunshine by high buildings will "draw" and

weaken the plants; planting near large trees will have a similar effect. An easterly aspect, with comparatively low shelter from wind, is best.

Dahlias are at their best during March and April, and to have them in bloom at that time, plants should be set out late in December and early in January. Divisions of crowns may be set out a fortnight later than young plants grown in pots. A stake should be driven firmly into the soil before planting, and the plants lightly shaded for a few days, should the weather be hot. After culture will be occasionally stirring the surface, tying as growth advances, thinning shoots where crowded, and watering. A mulch of stable manure should be applied at beginning of February, and will save a deal of watering and keep roots cool and moist; they must be maintained in this state in most soils, or red spider will attack and spoil the plants.

If exhibition blooms are desired, about six or eight shoots only should be allowed to grow, and from these the lateral shoots should be removed as they develop. The flower-buds should also be thinned, but not too severely, or coarseness will follow. After the plants "die down" they may be lifted and stored in a cool dry place, or may be allowed to remain in the ground till the end of winter, and then be lifted and stored until planting time. The cactus section is most popular, and the following are good up-to-date varieties:—"Florence M. Stredwick," "Fairy," "Mont Blanc," "Mrs. F. McQuade," "Mabel Kerslake," white; "Mrs. E. Mawley," "H. F. Robertson," "Sunflower," "J. P. Barber," yellow; "Premier," "Conrad," "Mrs. J. Cronin," "Vivid," "Oliver Twist," red; "Mrs. J. W. Wilkinson," "Mrs. Adrian Knox," "Pink Pearl," pink; "J. W. Wilkinson," "J. Weir Fife," "Sir A. Lamb," "Purple Jackson," purple; "Charm," "Cockatoo," parti-coloured; "Mrs. T Rooney," "J. B. Riding," "J. H. Jackson," "Mrs. G. H. Kerslake," "Germania," other shades and colours.

Flower Garden.

As the herbaceous plants finish blooming the stems should be cut to the ground, and in case of such as chrysanthemums the stools removed to some out-of-way place during the winter. The removal facilitates manuring and digging the beds especially, and the young plants will be hardier and sturdier when wanted in spring. A good dressing of fresh soil will be of more value than manure, especially in small gardens where particular plants are grown in the same beds each year. A few inches of the "top spit" of ordinary pasture land of the nature the plants require, with manure worked in with it, will make the garden staple almost equal to virgin soil. Too much stable manure is often added to the soil in small places, the consequence being that the soil becomes cold and sour. A dressing of fresh lime and some new soil will be of great benefit in such cases.

Beds for the reception of roses should be prepared, clay being added to light sandy soils. Well-rotted manure should be used, and worked deeply into the beds. Nothing is gained by very early planting of roses; next month will be quite early enough. A list of the best new kinds will be supplied in the June issue.

Hardy annuals may be planted, as also a number of bulbous plants, including Tigridia, Lilium, Iris, Tuberose, Lily of the Valley, summer-blooming Amaryllis, and many others.

Kitchen Garden.

Ground that has been occupied by tomatoes, beans, &c., should be got ready for planting onions, cabbage, &c., later on. When preparing land for carrots, beet, and other root crops, it should be deeply worked and liberally manured at the bottom of the trench. A rich surface, with a hard and poor bottom, encourages forking in such vegetables, instead of long straight roots. Seeds of early peas, onions, and various saladings, may be sown.

PROFITABLE POULTRY FARMING.

H. V. Hawkins, Poultry Expert and Lecturer.

Readers of the *Journal* will remember my articles on Poultry Breeding and Management in last May's issue. Those who followed the advice contained therein should now have a goodly stock of cockerels and pullets. The former may be troublesome, and doubtless you are pondering in your mind what to do with them. If of a pure breed, such as Leghorns, Wyandottes, Orpingtons, &c., select, say, two or three of the best, put them aside, and take special care of them as you will require a vigorous, typical specimen next month in your breeding pen. See that the selected few are of robust constitution, fair size, not too leggy, with bright eyes standing well out of the sockets, the comb erect and firm at base, and not too large, the serrations nice and even, no side sprigs.

After selecting what, to your mind, are the best, dispose of all surplus cockerels, according to quality, size, &c. Your neighbour may be glad to purchase one to improve his stock—pure-bred birds, well matured, are worth at least 7s. 6d. each. Having sold all you wish to, place the others in a separate yard by themselves, and prepare them for market; the sooner you get them off your hands the better. Fatten as quickly as possible, giving them a mixture of 1 part pollard, 1 part barley meal (and with it occasionally a little rice flour), and 1 part bran, add to this a little chopped raw beef suet, and boiled liver, using the liquid from the latter to mix the meal, which must be crumbly, not sticky. Give as much as the birds will eat readily, your object being to force on flesh. At midday, green food should be given, such as lucerne, lettuce, beet, or onions, chopped up. The birds relish this, and it keeps up condition. Have no fear of theorists who remark that onions will taint the flesh—you are only adding to the meal, not feeding wholly on any one particular food.

For the evening meal, give a handful of crushed maize and occasionally scalded barley or oats. It is astonishing how birds in confinement relish maize; it is easy to digest, but too much will darken the flesh (it is also too fattening for laying hens). My object is to show how to put on flesh and to have it white.

When skim milk is available, give your birds plenty, as it is rich in flesh formers. It also whitens and gives succulence to the meat

Pullets.

Pullets that since hatching time have been wandering and picking up most of their living by insects, &c., should now be penned up and fed as

directed by me in the *Journal* already referred to. If allowed full liberty and by constantly being on the wet grass and picking same, the development of the ovarium egg cluster is retarded.

Top Prices for Early Eggs.

You are anxious to get eggs, and now is the time to secure good payable prices. This will mean more care and proper feeding, but will amply repay the additional labour it involves. The main reason for the scarcity of eggs from early hatched pullets is mainly due to too much wet grass, which results in much food being wasted by passing through the system too rapidly owing to the excess of water taken in with the grass.

Pens Pay Best.

Penning up the early pullets with but little grass in the runs is a sure means of bringing them on to lay. We have only to ask ourselves the question, why do the pullets at Dookie and Hawkesbury Agricultural College competitions lay so well and pay such handsome profits?—It is because they have only a certain amount of liberty and are not kept in huge numbers—six in a pen—and those six fed on a ration which allows of more protein than is required in keeping up the repair of tissue, the balance goes to produce eggs.

I am informed that eight at least of the pens at the last competition laid on an average over 200 eggs each bird. This is surely conclusive evidence that by care and mating up the breeding pens, poultry breeding for egg production pays well. During my visit to South Gippsland, while lecturing at the farmers' classes at Leongatha, I was invited to visit a student who had eleven months ago purchased a copy of the May Poultry number,* and who set to work to follow out the instructions laid down, having had no previous experience. He built his pens with great accuracy. It is the Director's desire that the students shall imitate the teaching of each of the experts engaged in lecturing. However, I must not diverge from my subject. My friend, in following the sound principles laid down, has netted over £35 in less than twelve months, and now has quite a large asset in his flock of pullets. It is recognised that the South Gippsland district is a cold, bleak, wet one, and complaints are legion that the hotelkeeper and the housewife cannot get eggs in autumn and winter in this district, yet we have here an example of one who has made ample provision for drainage, shelter, dry, sound houses, and by proper feeding, has received an average of 11d. per dozen for his eggs. My conviction is that highly satisfactory results can be obtained in the coldest parts of Gippsland if cheap barns made of saplings and bark (obtained for the asking), 40 x 15 feet or larger if required, facing the north-east, well ventilated, and dry are utilized. Add to the ground floor a good load of hay, or dry litter, with ample supplies of grit, charcoal, coarse sand, oyster shells, burnt bones, and dust boxes. Give fresh water daily, and pay special attention to green food at midday. The morning meal, for the birds confined thus, should contain 1 ounce of animal food with at least 1½ ounces pollard and bran, mixed with boiling water, and given each morning at daylight, and grain, consisting of a mixed diet—1 part wheat, 1 short oats, and 1 maize—at night, a handful to each bird.

Twenty-five white Leghorns, black Orpingtons, silver or white Wyandottes, or silver Dorkings will lay all through the coldest weather. I have tested this myself, and have found the result excellent. The food should never be given to birds in troughs or on sacks, but scattered amongst the litter, enabling the birds to exercise themselves by scratching about for the food.

Who in the southern parts of cold Gippsland will have enterprise enough to test this?—Some may say, what about vermin?—There is little to fear in that respect, as vermin breed in October, November, December, January, February, and March, when eggs are cheap. It is only during the autumn and winter months that you will require to house the birds, and no fear of insect pests need trouble you, and your eggs will bring from 1s. 4d. to 2s. 4d. per dozen. Be on your guard against the three W's—too much Wind, too much Water, and too much Wheat.

PROPER BREEDING SEASON.

"When does the breeding season commence, and when does it cease?" are questions often asked, but too often overlooked. Many make the serious mistake of setting eggs in November and December, thinking they have not yet enough chicks out. Let me strongly advise such to be satisfied with a few early birds, than run the risk of losing the lot, through overcrowding, with late chickens. The birds of the air, from the sparrow to the nightingale, have their proper season. I ask, does it seem reasonable to expect a pen of birds, each of which may lay 175 eggs per year, to produce a similar number of chicks? - Decidedly not.

If you are going in for large flocks of birds, you must, of course, have more than one breeding pen. Do not overtax the stud flock. Carefully gather the eggs, and when each hen has laid her fifth egg, and not till then, commence to reserve for the incubator. Then each egg that is laid, up to about 40, should produce the strong embryo germ, that, when hatched, has stamina, frame, and good bone. It is more easily reared and matures twice as rapidly as those from eggs out of season, *i.e.*, November, December, and January, and is a sure layer when eggs are scarce. Such pullets hatched in August or September, or as early as July in the northern districts, will pay over 100 per cent. profit in a season.

I am anxious to show the farmer or his wife that the old idea of setting hens, when they are inclined, is out of date. We are living in days of improved methods—the result of man's investigation and experimentation. The old broody hen of seven summers is not a success. Artificial methods of incubation have now been brought to perfection, and the farmer may rely upon most of the machines now on the market, but should avoid the second-hand machines. Do not risk failure by beginning in the wrong way. Buy a good make, and even if it costs more, it will amply repay.

The eggs gathered during the months of July and August should then be kept for the incubator, as they will be worth much. (I am, of course, presuming readers have followed my previous articles on the treatment the stud birds should receive.) If your average hatch is only 60 per cent., you have the satisfaction of knowing that the parent birds have been in splendid trim, and not in an impoverished state, the result of being overtaxed, and that the heat of December is not going to worry you, having made up your mind to hatch early and to stop early.

Feed the Male Bird by Himself.

Feed the male bird well, give him twice as much as the hen, if not, the good results mentioned above may not be yours. To accomplish this will necessitate coaxing him in to a corner by himself. About 1 ounce of hemp seed and animal food (½ ounce of each) mixed daily in the soft food will increase his vigour.

Buy Early Season Eggs.

Eggs from prize birds are often advertised in the weekly papers in the months of August and September at 21s. per dozen, and from 21s. they are reduced to 7s. 6d. dozen, and possibly are from the same pen of birds.

Buy your eggs for hatching early, do not be misled in purchasing them at the reduced price. Bear in mind that the hen's condition is also reduced, and her egg is smaller and the germ weaker.

This is one of the reasons why folks say poultry will not pay, they having paid 5s. per dozen for eggs from such and such a winning pen, and after watching the broody hen with that care that the amateur usually gives her, seven or eight chicks appear, and the owner is happy for a time. But after three to five weeks a gradual drooping of the chicks' wings is observed, the legs appear very puny, and a hollowness is distinctly visible, showing a bluish colour. All such should be killed off, as they will never pay to feed, all the food in the universe will not give stamina to such. Do not buy eggs when at gift prices, and avoid shop window eggs, unless each egg is guaranteed fresh, and bears the name and address of the breeder, also the date when egg was laid.

Cottagers' Poultry.

Where only a small run is available, keep only one breed, and make it the best by keeping only a few, and that few of a good laying strain. Do not keep more than twelve birds in a yard 30 x 15 feet, and the house scraps will almost be sufficient for their maintenance. Sweep up the manure each day, and there will be no need to fear the municipal inspector. Unclean yards are not only an annoyance to your neighbour, but a menace to the public health. A dozen good fowls will furnish more eggs than the average family requires, and will leave a surplus for pin money. Think what it costs to buy absolutely fresh eggs all the year round!

DEVELOPMENT OF THE COMMONWEALTH.

Oversea Trade of the Commonwealth.

	Imports.	Exports.
First Quarter, 1905 ...	£9,523,249 ...	£13,690,619
First Quarter, 1906 ...	£10,772,863 ...	£19,651,702

Of the above totals for the first quarter of 1906, Victoria contributed one third.

THREE YEARS' EXPORTS TO THE UNITED KINGDOM.

	1903. £	1904. £	1905. £	3 Years' Increase.
From Victoria ...	4,509,971	7,602,958	8,133,006	80 per cent.
From Australia ...	17,057,527	23,568,918	26,968,307	59 per cent.
From Canada ...	26,669,855	22,621,164	25,684,679	Nil.

RECORDING DAIRY RETURNS.

R. Crowe, Superintendent of Exports.

"Good morning, Mr. Brown. My word, you have some very fine cows amongst your herd!"

"Well, yes, there are some good cows, a few better than others, but, taking them altogether, I dare say you will not find many better herds in the district."

"What kind of returns do you get from them?"

"There are 67 altogether and my last cheque amounted to £43: not bad for four weeks' supply."

"Yes, that is not too bad, but do you not think it possible to increase the yields? Do you keep any record of the individual returns secured from each cow?"

Mr. Brown smiled and looked at me suspiciously, wondering at my—to him—outlandish suggestion.

I hastened to explain that amongst the most advanced dairymen such a rule was in every day practice, and quoted an instance of one who had eleven cows, and could tell the daily, monthly, and yearly returns of each cow for the last few years.

Mr. Brown remarked that such was possible, no doubt, on the part of a man who had not much to do, and who wanted some means of occupying his time. It was practicable to carry out such a method with a small number of cows, and was probably worth while under such circumstances, but with a large herd it was impracticable, and out of the question.

"It pays, and if it is possible in one instance, it should be in another." I then mentioned a case where a herd of 150 cows was—by a system of recording individual returns—made to double the former average yields in two years by methodical culling and management.

"What would a grocer do if he did not keep accounts? At the end of the month or quarter it would not do to average his customers' bills."

"H'm, I'll think it over."

Knowing from previous experience what the result would be, I decided to remain and see the method started.

"Which of your boys takes the most interest in this branch of the farm operations?"

"Well, Tom, I believe, does. Here, Tom!"

As Tom appeared in considerable doubt, and to resent any additional imposition of duties in connexion with milking operations, I went on to explain, and asked for a sheet of Imperial size paper, that is about 30 inches x 20 inches.

"There is no such paper on the place excepting a newspaper, and I suppose that would not do?"

"Well, a large almanac, or show programme, or, by the way, if you have any brown paper about the house from the draper or grocer's."

A search was made, and from a bundle of various sizes, shapes, and conditions of brown paper, I selected a few sheets, and taking one, asked that the remainder be put aside for future use. With a ruler I quickly ran off 68 vertical spaces and 64 horizontal lines, the highest being 2 inches from the top, then along the top of same the name of each cow was entered, and down the left hand margin the dates were inserted, the sheet

was then tacked on the wall near where the milkers strained the milk into cans. It was a copy of that on this page.

MONTHLY CHART.

for the guidance of Dairymen in recording each Cow's Milk.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
NAMES OF COWS.																								
DATE	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK	LBS MILK
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31																								
TOTAL																								
TESTS. 1st WEEK																								
TESTS. 2nd "																								
TESTS. 3rd "																								
TESTS. 4th "																								
TESTS. AVERAGE																								

Scale—One-third of Practical Size.

On asking for scales none suitable were available, so I told Mr. Brown and Tom that I would be back again in time for the afternoon milking. In

the meantime I bought a spring scales to weigh up to 56 lbs. for 2s., and suspended same with a piece of wire near the chart. A lead pencil was attached to the wall with a string so that it would be always available.

Milking commenced, and I could see Mr. Brown was somewhat impatient and regarded the arrangement with suspicion, and remarked that the usual time occupied by milking the whole of the cows was just two hours, and with this innovation he doubted whether the cows could be got out of the yard inside three hours. At any rate, he resigned himself to the situation, no doubt thinking that when I was gone the chart would disappear as soon as Tom's interest flagged.

Each bucket was weighed separately, and the weight marked on the handle with a file; three weighed 4 lbs., and the remainder 3½ lbs. each. When the first bucket came along with "Jennie's" milk, the weight of can and milk was found to be 20 lbs., bucket 4 lbs., net weight of milk 16 lbs., date of the month, 7th. "Jennie's" column was found at a glance, and 16 entered on the lower space and opposite 7th. This took some time, as all the other hands stopped milking to watch the proceedings. I told them there was no necessity to do this, as each would have an opportunity of learning when they brought their quota along from each cow. I considered this warning necessary, as much depended on the time taken in doing this new work.

The first weighing in each case was necessarily slow, as a full explanation of the method had to be made to the milker; but before the milking was half through they were all able to find the places and read the weights without any difficulty, but Mr. Brown had in the meantime exhausted his patience and gone off to other duties. Tom, however, was interested, and had taken in hand the supervision of the system. When the cows were turned out, it was found that some ten minutes additional time was occupied. I explained that with a little practice the delay would be less, and in time the method would become part of the milking process. The whole of the milkers gathered round, and anxiously studied the figures; one was engaged in mentally adding the yield of the particular cows he milked for the evening, whilst another was laughing at "Jennie's" downfall. "Jennie," I learnt, was reputed to have been the heaviest milker; but the eye and the size of the bucket proved to have been at fault, and "Spot" had really given 19 lbs., whilst "Jennie's" came to 16.

I had another talk to Tom before leaving, and secured a promise from him that the system of recording results would be persevered with till the end of the month at least. At the end of the month Tom wrote me to say that he had ruled and set up another chart for the next term, and referred to the yields of the big brindle cow and some other members of the herd.

It was some two years later that I visited Mr. Brown's dairy farm, and Mr. Brown did not seem less pleased to see me than his intelligent son. An exercise book was produced a few minutes after my arrival, and I was shown the actual returns secured from each and every cow.

On asking what the cheque from the factory this month was, I was smilingly informed that it was £59 odd from 61 cows.

"And the price paid by the factory?"

"Was 8¼d., why, just the same price as for the month you were here before."

Tom said—"My word, sir, we found out some things before many months had past, we learned that some cows were little better than boarders who didn't pay their bills in full, and it was easy to show Dad that they were not paying for their grass and attention, so they were quickly put dry, fattened, and sold to the butcher, and now we know which cows pay us best, and which to rear the heifer calves from. Although you say the returns are good, we are quite satisfied that in another couple of years we will be getting much larger returns. There is really no limit to this method; we can see that if all the cows were as good as the best twenty the annual returns would be increased by 50 per cent.; we also see great possibilities in the testing of the cows. For the last three months we have had samples tested by the local factory manager, and those range from 3.2 up to 4.8 per cent. butter-fat."

Tom then produced the monthly charts, the first three of which were of brown paper, the others being of good white, serviceable paper, specially procured for the purpose. "For a time you will see they were made rather dirty, but I got a strip of tin 6 inches wide to put across the chart for the milkers to rest the heel of their hand on when entering up the yields. That kept them much cleaner." "What means this abrupt variation in the figures?" I remarked, in noticing a sudden falling-off in the yields in one of the charts. "Ah! that happened when Frank got a dog to help him bring up the cows. The dog used to race them like anything. Rover sometimes singled out a cow, and chased her round the paddock for all she was worth. This went on for a while, and the irregularity in returns was puzzling us all, until one day the dog was run over by a cart and killed. From that day on the yields in every case were more regular; in fact, an improvement towards the former good consistent supply took place, as you can see. No more dogs amongst our cows after that."

On turning over the monthly charts, I came to another one, in which a pronounced falling-off was indicated. On asking for a reason, Mr. Brown said, "That happened when Smith's lambs died with the cold. The equinoctial gales were on—they lasted nearly a fortnight. You'd have thought that Bass Strait was full of icebergs, so cold was it. We put the cows in the sheltered paddock after the second day. There are six chains of boxthorn hedge in the south-west corner, and the cows used to get down near it. They were given some hay, too, and you see the figures at once showed an improvement. And you see those four cows that came right up again in their yields? They were ones we rugged as an experiment."

"And this?" pointing to a sharp increase. "Ah! that occurred when the cows were changed into a fresh paddock, which had been spelled for a time. You can find a number of variations in the earlier charts, the reason for which we omitted to note. Now, however, you see, everything is jotted down, it does not take long, and there is money in it." And as I left Mr. Brown's last words were, "There's money in it, my man."

If preferred, weekly record sheets, one of which is reproduced on the opposite page, may be kept.

Record sheets, similar to those set out on pages 290 and 293, may be obtained from the Secretary, Department of Agriculture, Melbourne, at a cost of 6d. per dozen, post free. The sheets are of suitable size and strength for cowshed use. When ordering, applicants should mention whether the weekly or monthly sheets are required.

MILK YIELDS FOR WEEK ENDING 21ST APRIL, 1906.

Name.	Weeks calved.	Sunday. M.	Sunday. E.	Monday. M.	Monday. E.	Tuesday. M.	Tuesday. E.	Wednesday. M.	Wednesday. E.	Thursday. M.	Thursday. E.	Friday. M.	Friday. E.	Saturday. M.	Saturday. E.	Total.
Bessie	32	9	4½	7½	5	8	5½	7	5	6	6	5½	5	6	4½	84½
Linsey	26	11	4½	9	8½	9	7	10½	6	10½	4½	10½	4½	9½	6½	121½
Brindle	23	10	5	9½	5	10	5	9	6½	8	5½	8	5½	6	6	99
Marigold	21	11	4½	9	6	9	6	9½	6	10	5	10	4½	10½	5	106
Dandelion	20	8	6	8½	7½	9½	7	9½	6½	9	5	10	5	8½	6	106
Buttercup	20	15	7	10½	8½	13	9	12½	9	13½	8	11½	7	11	7½	143
Pet	17	8½	4½	8½	6	9	6	7½	7	7	6	7	6	8	5	96
May	14	14	6	11	6½	11½	6½	10	7	11½	5	13	5½	10½	6	124
Brownie	14	8½	5	9½	5	9	5½	8½	5	9½	5½	8	5	8½	5	97½
Lady	9	9½	8½	9	12	9	12	9	12	10½	9	9½	10½	10	10	140½
Polyanthus	9	8	6	7	7	6½	7	6	6	6½	5	5	6	5	6½	87½
Fanny	7	10	10	9	11½	9	11½	9	13	9	9	10½	10	9½	9	140
Silver	4	16	8½	13	11	14	11	14½	11	17	10½	14	9½	15	9½	177½
Jessamy Bride	3	10	9	9½	10½	9	10	9½	10	9	10	9	10½	9	9	134
White Aster	2	17½	8½	15	11	17	11	17	12	18	10	14	10½	17	11	189½
Bright Star	2	6½	5	7	6½	5½	6½	6½	7	6½	7	6½	6½	6½	6½	90
Semaphore	2	17	7	18½	8	18½	9	19	8	20	9	20	9	16	8½	187½
Saffron	2	25½	9½	24½	16	25	12	27½	12	30	11	30	11	28	12	274
Fawnie	2	17	7	14	11	15½	10½	13	10½	15½	7	18	9	15	11	184
Pansy	2	14½	6	13	7	14½	7	13½	8	15	7	14½	7	13	7	147
		256½	127	222½	169½	231½	165	228½	167½	242	145	234½	147½	222	151½	
Daily Totals ...	...	383½ lbs.		392 lbs.		396½ lbs.		396 lbs.		387 lbs.		382 lbs.		373½ lbs.		2,729 lbs.
		15	9	13½	12	14	11¾	13¾	12	14¼	10¼	14	10¼	13	10½	
Cream Results ...	...	24 lbs.		25½ lbs.		25¾ lbs.		25¾ lbs.		24½ lbs.		24¼ lbs.		23½ lbs.		173¼ lbs.

Daily average of herd—20 cows=390 lbs. Daily average per cow=19½ lbs.

SPECIMEN MILK RECORD SHEET.

Willsmere Park.

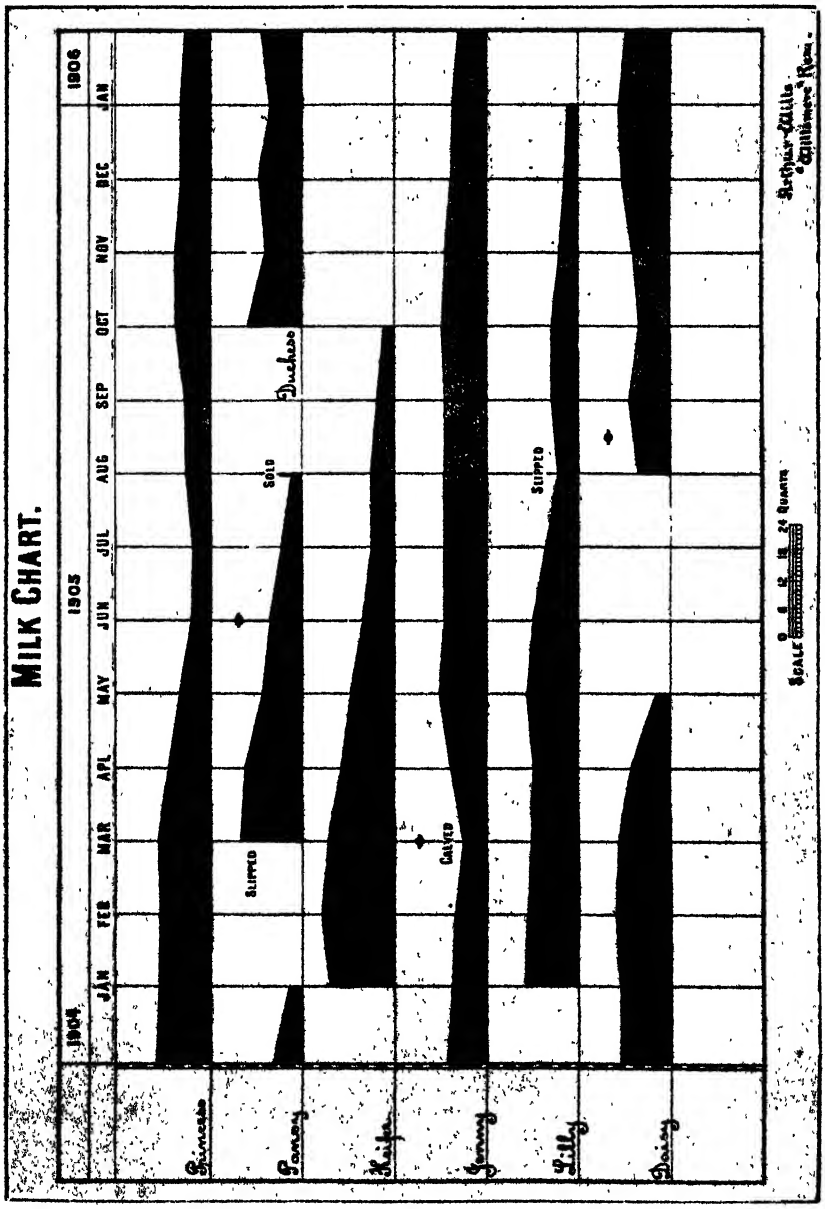
A graphic method of recording milk yields is adopted by Mr. Arthur Wills, of the noted Willsmere Park Dairy, at Kew. Mr. Wills owns the Willsmere Park property, which is romantically situated within five miles of the Melbourne Post Office, and for aught that can be seen to the contrary it may be in the Upper Murray regions—the only difference being the absence of cockatoos, parrots, and hares. The farm is undulating, and has a large frontage to the River Yarra, along the banks of which ancient red gums and even patches of scrub still exist. However, it is not my purpose to describe the farm or cows in this article so much as the method of keeping records. At the same time, I cannot refrain from making a short reference to the dairy.

ON THE YARRA.—5 MILES FROM CITY.

The milking-shed is beautifully situated, well paved and drained, and amply lit and ventilated; so well kept is it that it might at any time be made to serve almost as a dining hall. Mr. Wills himself is of an artistic temperament, and takes great pride in personally managing the property, and is conversant with every detail outside on the farm, as well as inside the dairy.

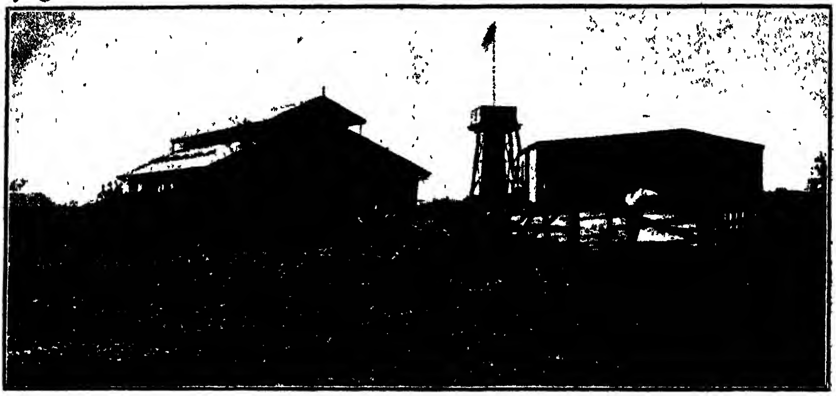
When milk is taken from the cow, the bucket is suspended on a spring balance with a circular face, and instead of the usual gradation into pounds, paper is gummed over the scale, and graduated to show quarts and fractions of same, and in lieu of figures being inserted on the recording chart, a line is drawn as indicated in the accompanying illustration. Each sixteenth of an inch from the base represents a quart, so that if the line be $\frac{3}{4}$ of an inch from the base, it indicates that the yield is 3 gallons, and the course of the line is up or down from day to day, according to the quantity of milk given.

The space between the base and the line is coloured and the yield illustrated in a graphic manner. The chart also provides for the noting of



the date of expected calving, the actual date of calving, the price paid for the cow, and in the event of her being sold, the price realized, and all such information. The illustration, however, is so clear and suggestive that

no description is required. The milk is then poured into a can supported by galvanized iron brackets on the wall; a tap regulates the flow over a



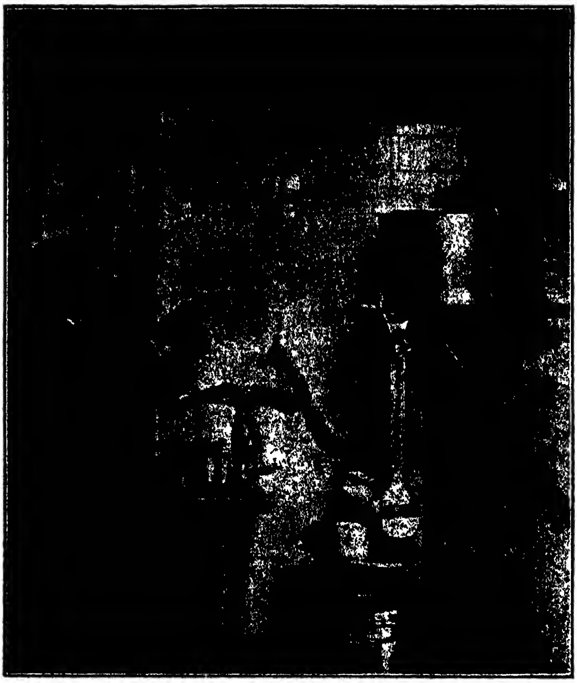
FARMSTEAD, WILLSMERE.

Laurence cooler suspended from the end of the wall brackets. The corner of the dairy where the cooling of the milk is carried out is lined from

MILKING TIME, WILLSMERE.

floor to ceiling with porcelain tiles, and the splashing of milk is thus easily removed. The space covered with tiles is 6 feet on one wall, and 4 on the other, with a height of 8 feet. These are so neat, so clean, and so appropriate that similar provision ought to be adopted by every dairyman.

Instead of the orthodox Laurence cooler with a fixed spout at the foot to catch the milk and deliver into a strainer—every dairyman knows how those fixed spouts get bent and provide awkward angles which are difficult to clean—Mr. Wills knocked the fixed spout off his cooler and suspended a movable one, so that when the cooler has to be cleaned, the spout is taken off and put in the wash-up trough, as well as the other appliances The cooler is thus more readily cleaned.



TESTING ROOM.

The wash-up room is large and suitably furnished. It has a good cement floor well drained, and contains a copper for boiling water. A galvanized iron wash-up trough, and moveable stands of galvanized iron for holding dishes, cans, buckets, &c., &c., also form part of the equipment. The man in charge of this department is worthy of special praise for the condition in which the place is kept. When washing milk delivery cans, the taps are always screwed out and taken to pieces, a detail which is often overlooked, even in butter factories.

Mr. Wills has a capacious silo filled for the winter. He grows lucerne, keeps good clean grass paddocks, feeds his cows well, and a better object lesson in cleanliness and method in the dairy could not be desired.

FLAX AND LINSEED INDUSTRY.

Jos. Knight.

Will Flax-Growing Pay?

This is a question frequently asked, at the agricultural shows and elsewhere, by those who are desirous of doing something in the way of giving it a trial. The following is a statement of the cost of production and the returns per acre:—

Income.		*Expenditure.*	
From 10 bushels linseed, per acre	£4 0 0	Rent per acre... ...	£1 10 0
From 5 cwt. fibre ...	11 5 0	Cultivation and seed ...	1 5 0
		Harvesting (with binder)	1 0 0
		Threshing	0 12 6
	£15 5 0	Spreading	0 7 6
	8 12 6	Drying and stacking (ready for manufacture)	0 7 6
Balance, profit per acre	£6 12 6	Manufacturing ...	3 10 0
		Total	£8 12 6

As to the yield of seed here given, I may say that it is below the average, and the expenditure is on a rather high scale. The above fully answers the question: "Will flax-growing pay?

Soils Suitable.

Flax is usually looked upon by those who are not acquainted with it as a plant requiring a damp or moist situation, but this is a mistake, as it will not thrive with excessive moisture. The plant loves a dry, warm, loose soil; where it is strong and stiff it must be well cultivated, so as to give the roots a free course during the early stages of growth. It matures rapidly in spring, and ripens its seed before the cereals, and if not assisted in the way suggested will become stunted and valueless for fibre-making purposes, although probably giving a fair return of seed. Generally speaking, the soil suitable for producing a crop of cereals will do equally well for a crop of seed and fibre, with a slight additional working as suggested.

The accompanying illustrations, marked 1, 2, and 3, give the plant and the two methods of growth. Fig. 1 shows the plant as cultivated for seed, fig. 2 as grown for fibre and seed, fig. 3 plant in flower with boll and seed. It will be seen by No. 1 that the plant, when given room to develop, throws out its lateral, or seed-bearing, branches, which render it useless for fibre-making purposes. Fig. 2 shows the plants grown close together, and drawn up tall and branchless, excepting just at the top, which, as may be expected with an imperfectly developed plant, will be less prolific in its seed-production. It is a difficult matter to say definitely what part of the State is most suitable for the crop, since it is found to do almost equally well in nearly all districts. The nature of the soil, however, is of some importance; it must be warm, dry, and free; cold, wet soils should be avoided. A free soil is specially valuable, as, before sowing, the land must be well pulverized. Excellent results are obtained in the loose mallee

FIG. 1.—FLAX GROWN FOR SEED.

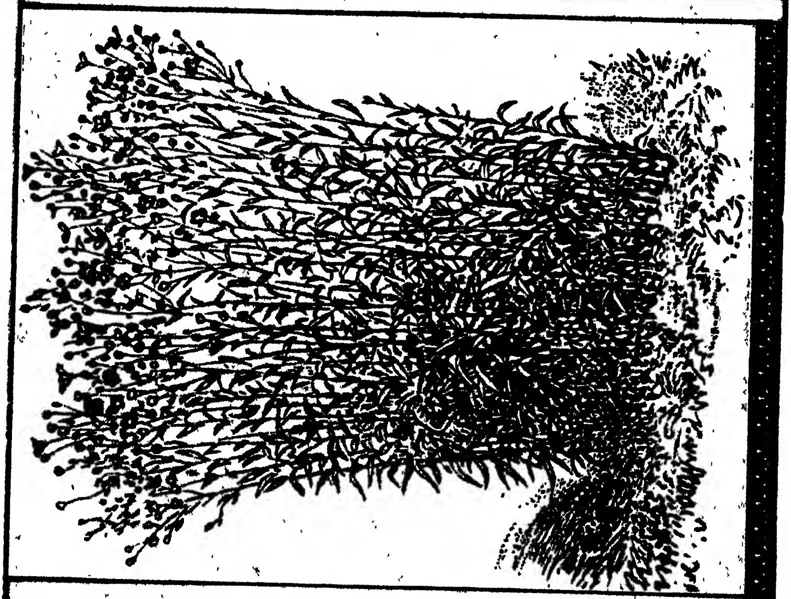


FIG. 2.—FLAX FOR FIBRE.

FIG. 3.—FLAX PLANT.

lands, when there is sufficient moisture for the growth of the plant. Generally it may be said that where a good crop of wheat can be obtained flax will do equally well, though wheat can stand a harder seed-bed. In Gippsland and the coastal districts there is less danger of growth being checked in the spring from want of moisture, and there is also a wider range of season for sowing.

Preparation of Soil.

No portion of the work pays better for attention than this. The seed requires a free soil to strike its roots down, as it is usually sown thickly, in order to produce tall, branching stems. It has little or no room for lateral roots, and has to seek below, to a large extent, for its supplies. Hence, where the soil is indifferently prepared, the young plants suffer. The soil should be pulverized to the full depth of the ploughing, and whilst deep cultivation is to be recommended generally, it is not at all times advisable. There is nothing exceptional required by this plant when grown under ordinary conditions, but thorough cultivation must be given. The seed is small, and requires to be kept close to the surface, which is impossible without proper pulverization. The advantage of this will be felt in all the various after operations, and should not be lightly overlooked, which, unfortunately, is too frequently the case.

Varieties.

There are many varieties in cultivation elsewhere, but only three are grown in this State. The first is known as "Riga," another as "White flowering Belgium," and the third, "Large Red," or "Calcutta Seed." This last is grown for oil-making purposes only, whilst the two former are employed for both fibre and oil production. The White-flowering Belgium is a spring variety, and is much more rapid in its growth, maturing a fortnight or three weeks earlier than either the Riga or Large Red; and whilst its yield of fibre may not be quite equal in quantity to the Riga, it nevertheless gives good returns when sown under proper conditions. One of its chief advantages is that of early maturing, as there is much danger with the late kinds being attacked by the boll worm which pierces the seed-pod, and totally destroys the seed.

Seeding.

The amount of seed necessary per acre depends on the nature of the crop required. When grown for seed purposes only, much less is needed than if for fibre, and the plant is encouraged to throw out lateral branches and to develop seed, whilst that grown for both fibre and seed production is sown close. The amount of seed required for fibre purposes is about one bushel (56 lbs.), whilst for seed only one-half to three-quarters of a bushel would be sufficient. The old system which was practised here and elsewhere, of sowing two and three bushels per acre, is a mistake.

Sowing.

The only method hitherto employed has been to sow broadcast by hand. Though drilling may be adopted for a seed crop, when fibre is wanted it

must be sown broadcast. This does not preclude the use of machinery, as some drills are fitted so as to distribute the seed evenly over and on the surface. Their use would prove a great advantage, as there is no more difficult crop to sow satisfactorily. When unevenly sown, the produce is also uneven, the stems differ in size, and a coarse appearance is given to the whole fibre. No doubt, machinery, when properly adjusted, will materially assist in preventing any defect of this kind. Those unacquainted with hand-sowing will do well to mix the seed with dry earth or ashes, to give bulk, so that the seed will be more evenly distributed.

It is impossible to lay down any hard and fast rule for the time of sowing, as the seasons vary; but it may be said that the proper time for sowing cereals, such as oats and wheat, will be found to suit linseed. What should be aimed at is to get the young plants thoroughly established, but not too far advanced, before the winter sets in. If too forward, they are apt to throw out the bloom, or become heavy and lodged. It cannot be fed off like wheat, when winter-proud, hence, in seasons when the rains enable the ordinary farm crops to be put in early, it would be well to leave the linseed till the last. It is not injuriously affected by frost, as generally supposed, and no danger need be feared from this source. Rapid growth is made in spring, but if checked for want of rain the plants become stunted and short. More disappointments have been caused by spring sowing than all others, as our seasons are quite unsuitable for this. It has frequently been found that self sown seed will produce excellent results, whereas a crop put in in the spring has been scarcely long enough to harvest. The growth must proceed unchecked, when once the spring has set in, and this cannot be relied on with late sowing under the conditions prevailing here. In humid districts such as Gippsland, there is a much wider range of season for sowing, and fair crops may generally be secured if put in even in July or August, but May or June is much preferable, and in the northern areas the sowing should be not later than May, or two first weeks in June.

Linseed, like most other small seeds, fails to germinate when deeply buried. Under such conditions, many lie dormant in the soil, and when turned up by subsequent tillage, grow, and become a nuisance. The soil should be brought to a fine tilth, the seed may then be sown on the surface, and a brush harrow drawn over it; in some cases a light roller answers the purpose. But where the soil is subject to crusting on the surface, rolling is not advisable, as it closes the pores and prevents the air from permeating the soil.

Manuring.

A series of experiments will be conducted in various parts of the State to test this question, as no doubt there are large areas of land, which are considered too poor to produce a crop, could be made to yield a fair crop of both seed and fibre by the aid of a suitable manure. I have noticed frequently that when manures are applied they naturally increase the bulk of crops produced; but I also notice that in the supplement of the *Journal of the Board of Trade*, dated 31st December, 1903, a series of experiments conducted with various manures are published, which go to show that, whilst increasing the bulk produced per acre, they in no way increase the yield of fibre, but rather reduce it.

WEEDING.

Little can be done with this crop after it becomes advanced in growth, and where weeds, such as dock, thistles, wild turnips, &c., show themselves, they should be removed, as they not only cause inconvenience and give a lot of unnecessary labour when treating the crop for fibre-making, but, to a certain extent, the sample of fibre produced is affected. Flax requires clean land; in many cases new virgin soil is chosen on account of its freedom from weeds, and the plant adapts itself well to these conditions. As to its power to suppress ordinary weeds, it will do so when fairly established, but those referred to must be removed during the early stages of the plant's growth.

STAGE OF RIPENESS FOR HARVESTING.

This question seriously perplexes inexperienced growers. They are told by old authorities that it must be taken when just past the blooming stage, and that, if allowed to go much beyond that, it is useless for fibre, and, strange to say, many writers lay this down as something which must be scrupulously observed. During the early stages of my labours in advocating the practice of securing a full crop of both seed and fibre, I met with considerable ridicule, and found it necessary to travel with samples of these products, and even then, in many cases, failed to convince the sceptical, as it was said that the fibre was valueless. Trade samples of fibre were then secured by our London agent, and when submitted to these critics they invariably, but unknowingly, reversed their decision by selecting the local article as better.

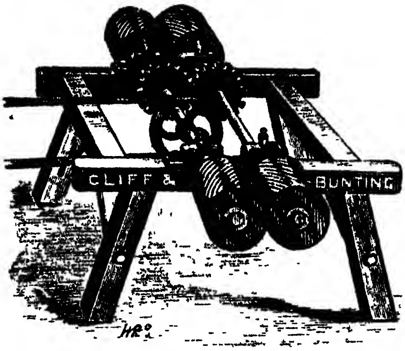
That seed and fibre can be secured from the same crop has been proved over and over again. To obtain the best sample of seed, the crop should be fully ripe, and this will give—contrary to European precedent—an excellent fibre, such as we have been putting on the market, realizing £45 per ton. Upward of 50 samples have been obtained from various sources, all of which are the produce of fully-matured crops. I have met a few who still adhere to the opinion that cutting while in bloom is the proper course, but such men are not found in the fibre market. Unfortunately, agricultural societies do much to maintain these erroneous ideas. With good intentions they offer prizes, and appoint judges who carry with them their old world prejudices.

The plant matures its seed somewhat unevenly. The top seed-bolls ripen first and open. When this stage is reached the crop should be harvested without delay, and treated similarly to oats or wheat, and it is advisable to get it in stooks as soon as possible, to avoid loss in seed. It will be found that the unripe bolls fill up considerably when in the stook.

MODE OF HARVESTING.

One of the most difficult ancient notions to break down is in connexion with the harvesting operations. The recognised method is pulling up by the roots, and it is surprising what laboured arguments are put forth to prove that it is absolutely necessary and indispensable. It is said that the roots must be on the plant, or the oil escapes, or that the water gets in the stem; in fact, all sorts of troubles are predicted if it is done in any other way. Fortunately, success is achieved by the simple method of cutting with an ordinary reaper, or even with a reaper and binder; and, further,

where the land is properly prepared, the cutting is accomplished without loss of fibre, for no fibre exists in the roots, or for one or two inches of the lower portion of the stalk, and modern mowers are now made to cut so



THRESHER OR BOLL CRUSHER.

close that the stubble is scarcely noticeable. If the old system was necessary, it would be folly to advocate flax cultivation in this State, as the labour required is not available for what is, at best, a disagreeable task. Most growers adopt the system of cutting with a binder, and, with the assistance of a man to take the sheaf from the machinery, the work is well

STACK.

done. A few prefer the ordinary mowing machine, with reaper attachments, as they state the best results are obtained by that means. This considerably simplifies flax cultivation, and renders it much more attractive.

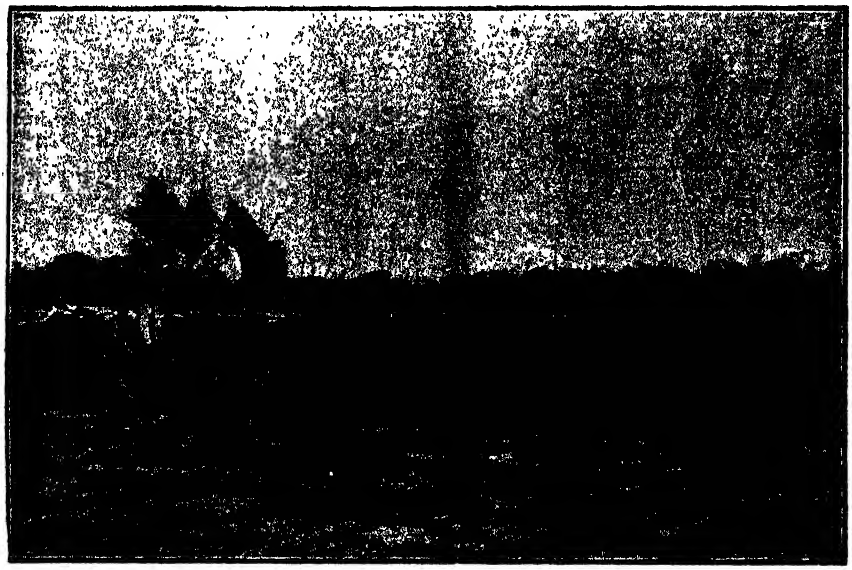
The after operations are the same as in other crops; the sheaves are stooked until dry, when they are stacked ready for threshing.

THRESHING OR BOLL-CRUSHING.

This operation is carried out in various ways. The old system of spreading out on the floor and bruising the bolls with a flat mallet is altogether too tedius; so also is the rippling, and the ordinary thresher is expensive. The illustration on the preceding page shows a machine made by Messrs. Cliff and Bunting. Many of these are now in use, and work well. The seed is afterwards passed through a winnower, and easily cleaned. It may be pointed out that the sheaves are not untied, and that the heads only pass through the rollers. A spring is used to keep the two rollers together, and give the necessary pressure.

RETTING.

This is perhaps the most difficult operation to learn. It consists of rotting, or destroying the gum which binds the fibres to the woody portion



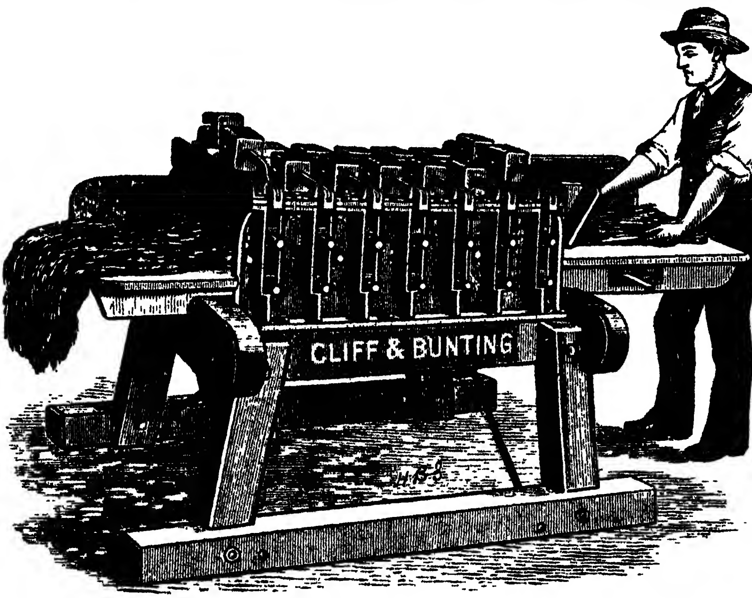
DEW RETTING AND DRYING.

of the plant, and it requires to be done in such a manner as to avoid the decaying process being carried so far as to affect the fibre. There are various methods by which this is accomplished. In European countries the straw is placed in water, sometimes running streams. In Ireland and in other countries pits are used, which are considered by some to be an advantage. This system has been carried out in this State, but its disagreeable nature creates an unfavorable impression, as it gives off an offensive odour, and pollutes any water-course into which the discharge is made. It is entirely unnecessary for the production of fibre, and is not to be recommended.

Dew Retting.

This is by no means a new process. It has been employed for ages past for both flax and hemp. Acres of ground are covered in the manner shown in the illustration. This method of retting flax, although simple and cheap, costing as it does about 15s. per acre, is the one operation which requires skill and care. If insufficiently retted, it is difficult to treat, and if overdone the fibre is seriously injured, and its value reduced. The test is easily made, for as soon as the fibre separates freely from the inner or woody portion, when broken, it may be considered sufficiently far advanced to be removed, and when dried the decay is arrested; the material may then be stacked and treated as opportunity permits. The knowledge, with a little experience, is easily acquired.

The system of degumming flax straw is likely to undergo a revolution in the method of treating it. A company is now being formed in the city who will purchase the straw either threshed or unthreshed, and intend destroying the gum referred to by a chemical process. Should this company be able to treat the product on commercial lines in the same manner as that



BREAKER.

done in the experimental work there will be a big future before them. They are having extensive machinery erected, and expect to be in full working order within a short time. The samples of fibre produced by this process appear to be superior to that of the ordinary retting, being strong, clean, and having a white lustrous appearance. The work of degumming is completed in two hours, and when dried the straw is ready for the operation of extraction, which is similar to that of straw which has been retted in the ordinary way—that is, by breaking and scutching.

The promoters of this company purpose erecting treating plants in the various flax-growing centres, and carrying on the work in a very large

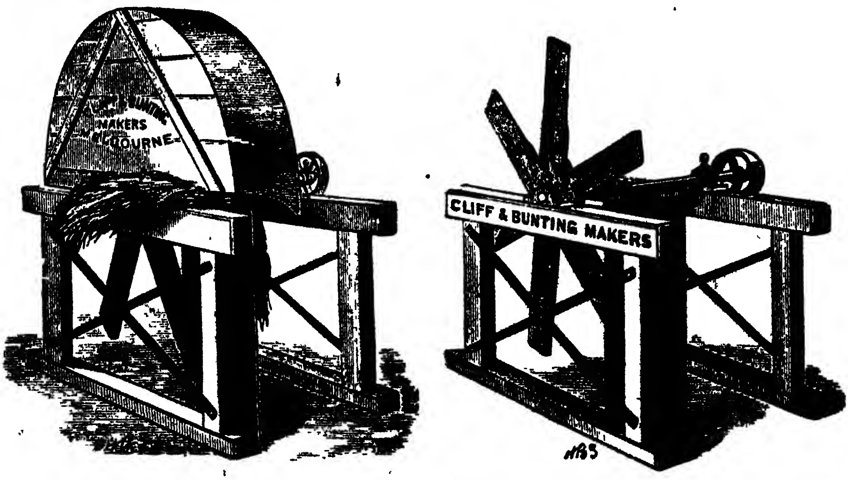
way. I am perfectly satisfied in my own mind that this method is an improvement on the old system; but I am unable to say definitely that the company will be able to carry out the work in such a way as to make it a financial success. The advantages of this system of purchasing flax straw to small growers will be considerable, and will enable them to market the product without incurring the expense of providing machinery.

Breaking and Scutching.

This consists of crushing the retted straw betwixt fluted rollers, and afterwards passing it through a beating or brushing process. The first

DOUBLE SCUTCHER.

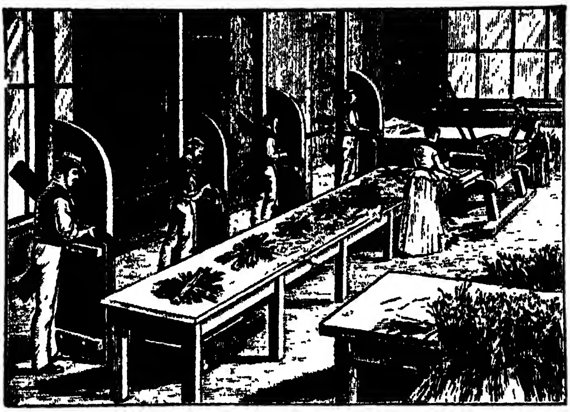
operation breaks up the non-fibrous portion of the plant in short bits from a half to one inch in length, which is readily separated in the scutching process.



SINGLE SCUTCHER.

The whole of the machinery is driven by a small oil-engine, a 4-horse-power being considered sufficient. The accompanying illustration shows a factory as fitted up by Messrs. Cliff and Bunting. The cost for machinery and fittings, exclusive of the engine, amounts to about £75; its capacity is said to be about 4 cwt. of dressed fibre per day.

After passing through all the various stages, the fibre is put up in bales similar to wool-packs, weighing from 4 to 5 cwt. each. The tow, which consists of broken and out-of-place strands of fibre, is cleaned and served in a similar manner, and as the value of this is only about one-third of ordinary fibre, skill in manipulation is shown by reducing this to a minimum.



INTERIOR OF FLAX FACTORY.

The Department of Agriculture has now secured a complete flax treating plant with power to drive same. It is intended to give demonstrations in various parts of the State, and to treat small lots for growers, in order to show what can be done. No doubt had this system been adopted when the bonus was in force, much better results would have been achieved.

The Commercial Value of the Industry.

As regards the market for flax, there is no need to look beyond our own State, as the local demand is more than we may reasonably hope to satisfy for some considerable time to come. The inducements offered by manufacturers show clearly a desire for a home supply. Messrs. Miller and Co. have for many years paid special attention to the development of flax-growing, and have imported the latest and most approved machinery to assist those engaged in the industry. They do not, of course, pretend to advise on questions relating to its growth and cultivation, but offer liberal concessions in regard to machinery required, and also are prepared to purchase the fibre at a price equal to, or in advance of, that given for the imported.

It has been asserted in some quarters that flax-growing is a decadent industry, and that the fibre and oil have almost disappeared from the list of the great products of the world. Quoting from the *Journal of the Department of Agriculture and Technical Instruction for Ireland*, I find that the linen industry occupies the third place in importance in the British

textile industries, the total value of linen manufactures exported from the United Kingdom for the year 1904 amounting to £5,727,054.

The sources of supply may be shown from the yields of flax in the various countries as follow:—

Country.	Yield of Flax in Tons.			
	1899.	1900.	1901.	1902.
Russia	185,703	275,000	310,527	497,341
Austria	41,090	49,518	54,567	50,659
France	12,423	19,103	24,404	15,812
Italy	18,400	18,400	18,400	20,000
Germany	16,875	15,590	13,125	11,250
Poland	13,500	13,500	13,323	13,500
Belgium	11,000	10,919	9,674	9,674
Ireland	6,743	9,479	12,797	10,975
Hungary	9,257	9,814	9,883	12,199
Holland	4,902	6,751	8,275	8,552
Roumania	3,590	5,965	9,393	7,625
Other countries	3,000	3,000	3,000	3,000
	326,483	437,039	487,368	660,110

The following table gives the quantity and value of the raw material (flax, tow, &c.) imported into the United Kingdom during the year 1904. The figures are taken from the *Journal of the Department of Agriculture and Technical Instruction for Ireland:*—

IMPORTS OF FLAX AND TOW INTO UNITED KINGDOM.

From.	Year 1904.	
	Quantities.	Value.
FLAX.	Tons.	£
Russia	39,660	1,523,706
Belgium	17,494	1,094,987
Holland	3,415	171,542
Other countries	1,445	46,126
TOW.		
Russia	7,423	233,259
Other countries	5,480	115,855
	74,917	3,185,475

It will be seen from the above table that Russia supplied 47,083 tons of flax and tow, almost two-thirds of the total quantity imported.

The average cost per ton of flax, used in the linen trade of the United Kingdom (1902) is as specified:—Belgian, £64; Irish, £50; Dutch, £49; French, £44; Russian, £37.

CONCLUSION.

We have seen that this industry is an important one—a fact recognised, not only in Victoria, but in other countries as well. In Ireland we find the associations import teachers from Belgium to show the farmers the best means of treating the flax crop. In the report of 1900 it was stated that arrangements had been made for the introduction of an expert with machinery to travel the district shows, and give object lessons in its manipulation. When we consider that this is one of the oldest and most extensive fibre-producing countries of the world, it is not unreasonable to suggest that something of a similar nature should be done here; but to introduce an inexperienced hand to the altogether foreign conditions would be to court failure. There is an abundance of evidence of this existing already. To be successful it will be necessary to adopt a system suited to present conditions, and this, coupled with the use of approved modern appliances, is all that is required. The French Government is alive to this fact, and is now giving £1 5s. per acre as a bonus for flax cultivation. Russia is offering liberal concessions to those entering into the industry. But in a young country like this, with virgin soil and a superior climate, the industry should flourish.

PROGRESS IN THE KING RIVER VALLEY.

Temple A. J. Smith, Tobacco Expert.

That portion of the North-East, on the King River, embracing Whitfield, Edi, Cheshunt, and Moyhu, is comparatively little known to the general public. Yet it is one of the most suitable districts in the State for close settlement and general farming. Almost any crop that is grown in Victoria will thrive well, and the climate and soils are eminently adapted for intense culture.

Maize, hops, tobacco, potatoes, broom millet, cereals, and many kinds of fruit and nuts are grown with success. Dairying is largely carried on, the fresh, pure water and cool nights, combined with the easy growth of fodder crops, greatly assisting this industry. Sheep and cattle fatten readily on the natural and artificial grasses on the river flats and foot hills.

The various permanent creeks which feed the river have each their own valleys, for the most part consisting of rich soils, and capable of irrigation, and the greater part of the river flats is also irrigable, though too little has been done in this important direction by settlers. The successful example of the few, however, who use pumping plants is being followed by others, and in the near future a large proportion of the settlers will see the benefit of making crops practically certain by utilizing the beautiful stream flowing past their properties. The valley of the King River is served by the first narrow-gauge railway built in this State, connecting with the main line at Wangaratta, one of the most thriving country towns in Victoria, situated forty-five (45) miles from the New South Wales border, on the main line to Sydney. This is an advantage to the district, inasmuch as the residents in the drier areas north of the Murray River can be supplied with the various crops which cannot be grown in their own vicinity, quantities of fruit, potatoes, pumpkins, chaff, &c., finding their way to the sister State. A generally dry season means increased returns to the favoured settlers in this valley, as droughts, in the real acceptation of the term, are unknown, and prices for their produce at such times are higher. In past seasons chaff has been sent to

New South Wales, and sold as high as £11 per ton, and pumpkins at £9 per ton, potatoes also realizing at times very remunerative prices. The altitude varies from 800 feet to 1,200 feet in the valley. The scenery is very pretty and further back in the mountains very fine, the falls at Mount Cobbler being frequently visited by tourists, while smaller falls are to be found amongst the lesser hills. The rainfall averages close

"MAMMOTH" PUMPKINS.

"PINK EYE" POTATOES.

upon 40 inches, the drier months being January, February, and March. Autumn rains are, however, usually to be expected in the two latter months, and it is rarely found that no rain has fallen in either of the three months mentioned.

Soils.

Result of Analysis of Some Soils from the King River Valley.

	Parts per 100,000.			
	Nitrogen.	Phosphoric Acid.	Potash.	Lime.
Byrne, Moyhu	350	340	490	380
Neylon, Moyhu	190	480	580	530
Smith, Cheshunt	190	320	560	480
Howard, Cheshunt	180	350	360	520
Hall, Whitfield	110	180	340	220
Swan, Loudrigans	100	170	390	230

The soils of the flats consist chiefly of alluvial deposits, varying in depth to 14 feet, and containing a fair percentage of sand. They are for the greater part naturally well drained, having a porous subsoil, with gravel bottom. The terraces and foot hills are chocolate, with clay

subsoil, in some cases reaching a depth of 25 feet. The hills and table lands on the western side of the river carry rich volcanic soils.

Maize.

That maize can be successfully grown is shown by the accompanying illustrations, the subjects of which were grown, without irrigation or

"Silvermine" maize,
Edi Experimental Farm.

"Hogan's Early Red" maize,
Mr. Anderson's Farm, Cheshunt.

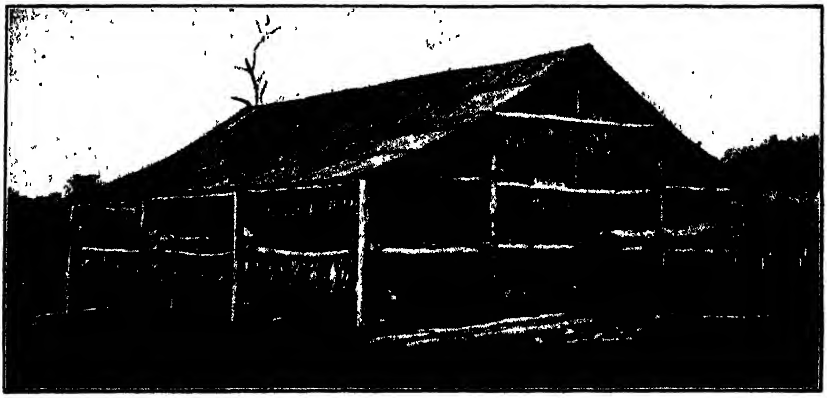
manures, in a season drier than usual. The stalks measured up to 13 ft. 8 in. in height, and are bearing from two to three large cobs each. There are several other fine crops in the district, both for grain and fodder, yet the acreage devoted to this crop is not one-hundredth part of what could be produced. Nine plots of different varieties have been tried during the present season at the Government Experimental Farm, Edi, all of which have made good growth, bearing fine cobs. The varieties showing most promise are Hogan's Early Red and Silvermine. Of the others, Ninety Day, Eclipse, and Leaming are good seconds. The first-named should be admirably adapted for silage use, keeping green late into the season with a long solid stem.

Potatoes.

Potatoes are grown in limited areas by many of the settlers, the yields averaging from 4 to 8 tons. This is a crop also that might be more extensively planted with advantage, and with judicious selection of seed the product would be equal to any grown in the State. The field shown in the photograph is a 3-acre crop of Pink Eyes, grown by Mr. Maconachie, a Whitfield settler, 4 cwt. of a special fertilizer being used per acre. Brown's River, Peach Bloom, and several of the early varieties also do well.

TOBACCO.

The district has for many years borne a reputation for supplying the best pipe tobacco grown in Victoria, and the quality has been steadily improving of late years owing to the introduction of better varieties, and



TOBACCO SHED (UNFINISHED), SHOWING TOBACCO JUST HARVESTED.
Crop (17 acres) estimated to yield 10 tons.

improvement in general treatment. A better class of curing shed has also been adopted by some growers. The illustrations show a new shed of Mr. Gibson's, with a quantity of new tobacco, just harvested, hanging on the tiers. It will be seen that this shed is not complete, the sides

TOBACCO SHED, 32 × 40 FEET, SHOWING SHUTTERS FOR VENTILATION OR CLOSING UP.
Built of bush timber. Capacity, 3 tons cured leaf. Cost £30 for labour and material. Shed is also used for drying Broom Millet.

having yet to be closed in. Latterly some very good cigar leaf has been produced, and some highly remunerative returns made by several individual growers. A grower at Moyhu, who cultivates 30 acres annually, has sold on an average leaf to the value (gross) of £750 per annum over

the last three years, off this area. Another grower at Cheshunt realized (gross value) £523 and £417 from 22 acres. In both cases the land was unmanured. A large proportion of the crops is sold to Adelaide buyers.

TOBACCO CROP AT CHESHUNT.
Lacks variety in foreground.

This particular crop is admirably suited to small holdings. The cost of growing is from £6 to £8 per acre. A photograph of an eight-acre crop, machine planted, shows in the foreground some fine plants of the

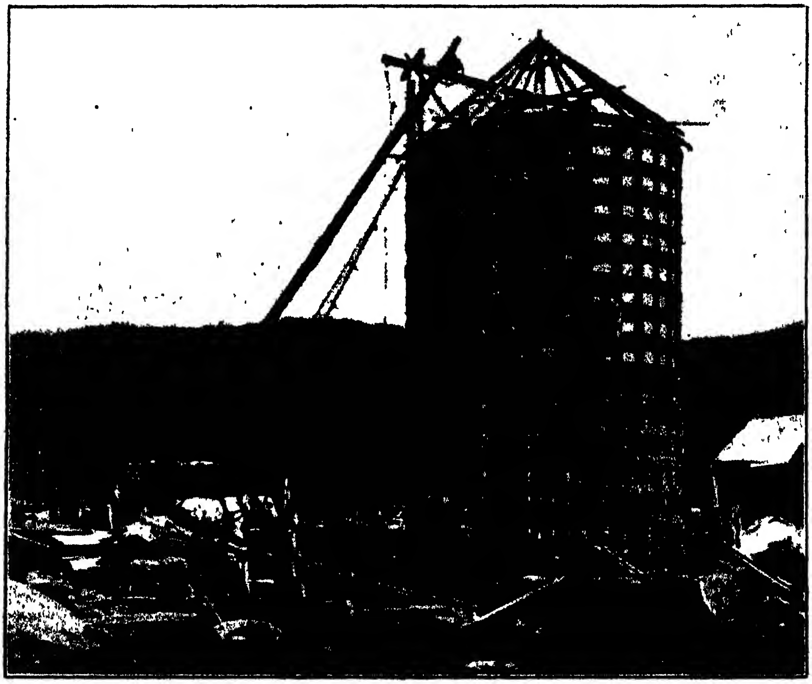
PORTION OF MR. D. GIBSON'S DAIRY HERD.

Lacks variety, grown at Cheshunt. A crop of Blue Pryor tobacco at the Edi Experimental Farm is shown on the cover.

Dairying.

Nine-tenths of the farmers are engaged in this important industry, and the butter shipped from the district is of very superior quality, bringing

prices as high as 116s. per cwt. With greater attention to the growth of fodder crops, the universal establishment of silos, and better housing of the stock, the output might be doubled. Several silos are now being erected on approved plans, as specified in the *Journal*. The over-ground silo, shown in the accompanying illustration, which is being erected by Mr. Maconachie, is an example of what can be done by a handy man. Mr. Maconachie never saw a silo prior to erecting his own, which is excellently constructed. Several other silos, both pit and over-ground,



OVERGROUND SILO BUILT BY MR. MACONACHIE.

are also being made by neighbours on lines laid down in the *Journal*. Some stacks of ensilage are also being built.

Broom Millet.

This crop has been more extensively grown by Whitfield settlers during the last two years, and promises to be most useful, as well as remunerative. The fibre of King River production is spoken of as superior in quality to that grown in New South Wales, being more flexible and not so coarse. The yield of fibre averages, approximately, 8 cwt. per acre, valued at £25 per ton. The seed yield is from 5 to 10 bags per acre, and it sells at 5s. to 6s. per bag. The crop is harvested on the green side, and the stalks can be utilized for ensilage after the crop has been taken off. The labour required to produce the crop is considerable. The land must be kept clean and the plants thinned out. The harvesting cannot be accomplished by machinery, each head of millet having to be cut by hand. Sheds are necessary for drying purposes. The average cost of growing and preparing for market is about £4 to £6 per acre.

The photograph of Broom Millet represents a crop of 22 acres, the height varying from 6 feet to 12 feet. The variety is the Dwarf Missouri, the estimated yield being 9 cwt. per acre. No manure was used.

Pumpkins.

The crop of pumpkins shown on page 310 was grown by Mr. Anderson, of Bongamero, Cheshunt, the variety being the Mammoth.

CROP OF BROOM MILLET, CHESHUNT.

The plot was unmanured. Many of the individual pumpkins weigh over 80 lbs.; some of those shown are close to 100 lbs. The two standing

APPLE TREE ON MR. ANDERSON'S FARM, CHESHUNT.

on end measure 3 ft. 6 in. in he'ght and 18 inches in diameter. Crops of 20 tons to the acre are not unusual, while it is one of the cheapest crops to grow and harvest known, and occasionally large quantities are sold to New South Wales buyers at high prices.

Other Crops.

Other crops, such as arrowroot, chicory, beans, onions, flax, and sugar beet, have been grown for experimental purposes, and have all proved suitable to climate and soil, and in time will probably be grown largely for profit. Many fruits, including red, white, and black currants, do well; while apples, pears, plums, cherries, nuts, and other fruits grow luxuriantly. The apple tree photographed measures 46 feet across the width covered by branches, and yields over a ton in some seasons.

Fodder Crops.

For the growth of maize, millets, amber cane, imphee, and artificial grasses the district is eminently suitable, and the cultivation of all of these is gradually increasing. Lucerne has proved hard to establish in some

MR. P. HOWARD'S LUCERNE FIELD, CHESHUNT.

cases, but has been successful in others, as the view of Mr. Howard's five-acre plot at Cheshunt shows. This crop is four years old, and has been cut twice this summer, giving a heavy crop of hay with each cutting. The Golden Crown grass, *Paspalum dilitatum*, also thrives well, as do the fescues, Rye grass, clover—both white and red—and many other artificial grasses. Japanese millet is now grown by many farmers with excellent results, and is highly spoken of as feed for dairy cows in the green stages, and makes a very fair hay with the last cutting in the autumn.

IMPROVEMENT IN LATE YEARS.

A little more than 30 years ago this portion of the King River district was a cattle run, and homesteads were few and far between. The land was difficult to clear, being heavily timbered with red and white gum, the undergrowth consisting of dog-wood scrub, wattle, and bracken. The distance from a railway was 30 to 40 miles, with a bad road to traverse. However, since the advent of the narrow-gauge line some five years ago, the district has developed very fast, and it is now fairly closely settled. The Whitfield estate, purchased by the Government under the Closer Settlement Act, has been the means of placing many families on the land, there being now on the estate nearly 200 souls, where previously not more than ten existed, and many nice homesteads are now to be seen throughout the estate. The improvements made by the settlers during their four years' occupation, in clearing, fencing, building, &c., are very considerable, and, having overcome the initial cost of settling, it is to be expected that their results in the future will be good. They are now in a position to devote more of their time to cultivation, and by the more general use of ensilage, and attention to intense culture, their profits might be doubled.

MR. MACONACHIE'S HOUSE AND ORCHARD, WHITFIELD ESTATE.

It is gratifying to note the better class of cattle on the farms, as compared with past years, and the evidence of increased prosperity throughout the district. Good horses and vehicles are to be seen almost everywhere, and more comfortable houses than heretofore. The resources of the district are very great, and farming methods are gradually improving. Within the last twelve months at least five silos have been erected, and the use of chemical manures is becoming more understood and adopted. The prospects generally leave little to be desired. An important town in Wangaratta is growing fast, and, though the distance from the metropolis is 170 miles, the advantage of having a New South Wales market quite counterbalances such a handicap. Roads and climate are good, the price of land moderate, as compared with many other parts of Victoria, while the water supply is of the purest, and is abundant.

A prosperous co-operative butter company has creameries at intervals of 6 or 7 miles up and down the valley, and State schools are to be seen

in every direction. The past summer was a severe one, yet the crops generally are good, and, with irrigation and judicious management, failure would be almost impossible. The development during the past ten years is so marked that any thinking person must realize that great possibilities may be expected in the same period ahead.

THE ORCHARD.

James Lang, Harcourt.

The weather is unusually dry for the time of year, but good rains may fall at any time, and make it much easier to prepare the ground for planting. This work should be pushed on with as rapidly as circumstances will permit, so as to be ready next month. If the land requires draining, it should be done before the ground is planted. Drains should be not less than 2½ feet deep, and if tiles are used they should be from 2½ in. to 3 in. in diameter; 4-in. tiles should be used for main drains. If the land to be drained has rather a steep fall, the drains should run diagonally across the fall of the hill; by this means the water is cut off better than if the drains are run straight up and down the hill. Where stones are plentiful they may be used for the drains, but are liable to choke them up if the ground is sandy. Temporary drains may be made with brushwood; these will last a few years, and can then be replaced with tiles.

It is astonishing how few orchardists grow grape-vines even for home use. The excuse generally given is that they do not grow very well, but if varieties suitable for the district are planted, they would succeed moderately well, even in the cooler districts. A quarter of an acre of land would provide sufficient grapes for a good-sized family, and also a few cases to send to market. Early White Malvasia is one of the earliest varieties to ripen; it is small in bunch and berry, and is valuable only for its earliness. Chasselas comes next in order of ripening, and is a much superior grape to the variety previously mentioned. Blue Imperial or Ulliade, a dark oval grape, is also good. Black Hambro and Muscat Hambro are very fine varieties, Muscat Hambro being considered the best-flavoured grape in cultivation. The above-named varieties are all suitable kinds to grow in the cooler districts of the State, and always give a good supply of grapes. In the warmer parts of the State, such varieties as Waltham Cross, Red Prince, Centennial, Muscat of Alexandria, Madresfield Court Black Muscat, and Doradilla would succeed; these are all fine varieties, large in bunch and berry, and should be grown in the warmer districts only.

Take off Codlin Moth bandages from the trees, and scald them to destroy the larvæ which may be harboring in them. When dry, put the bandages away for use next season. It may be well, also, to scrape all loose bark where the grubs can get shelter. All possible means should be taken to reduce the number of the grubs.

Owing to the exceptionally dry season, Red Spider has been much in evidence, and will require to be dealt with before next season. Many orchards which have come under the notice of the writer have suffered very severely from this pest. Spraying the trees with kerosene emulsion is a good remedy.

If not already done, peas intended for green manuring of the orchard should be put in at once.

STATISTICS.

Rainfall in Victoria.

FIRST QUARTER, 1906.

TABLE showing average amount of rainfall in each of the 26 Basins or Regions constituting the State of Victoria for each month and the quarter, with corresponding monthly and quarterly averages for each basin deduced from all available records to date.

Basin.	January.		February.		March.		Total for First Quarter, 1906.	Average for First Quarter.
	Amount, 1906.	Average.	Amount, 1906.	Average.	Amount, 1906. *	Average.	*	
Glenelg and Wannon Rivers	0.13	1.51	0.80	0.77	2.31	1.55	3.24	3.83
Fitzroy, Eumerella, and Merri Rivers	0.32	1.64	1.01	0.89	1.84	1.82	3.17	4.35
Hopkins River and Mount Emu Creek	0.13	1.72	0.80	1.05	3.41	1.84	4.34	4.61
Mount Elephant and Lake Corangamite	0.16	1.79	0.55	1.16	2.55	1.86	3.26	4.81
Otway Forest	0.19	3.29	0.46	1.66	3.09	3.22	3.74	8.17
Moorabool and Barwon Rivers	0.11	1.57	0.51	1.22	4.03	1.55	4.65	4.34
Werribee and Saltwater Rivers	0.26	1.67	0.60	1.58	3.33	2.00	4.19	5.25
Yarra River and Dandenong Creek	0.39	2.79	0.72	1.70	3.94	2.44	5.05	6.93
Koo-wee-rup Swamp ..	0.39	2.71	0.50	1.39	3.49	2.21	4.38	6.31
South Gippsland ..	0.26	2.77	0.38	2.12	5.33	2.47	5.97	7.36
La Trobe and Thomson Rivers	0.31	3.05	0.54	1.92	5.49	2.33	6.34	7.30
Macallister and Avon Rivers	0.21	2.25	0.34	2.28	6.72	1.47	7.27	6.00
Mitchell River	0.23	2.79	0.18	2.94	6.64	1.49	7.05	7.22
Tambo and Nicholson Rivers	0.28	2.88	0.22	2.62	10.81	1.37	11.31	6.87
Snowy River	0.30	3.26	0.42	2.75	8.31	2.11	9.03	8.12
Murray River	0.02	1.31	1.00	1.37	4.78	1.68	5.80	4.36
Mitta Mitta and Kiewa Rivers	0.12	2.01	0.76	2.47	7.42	2.46	8.30	6.94
Ovens River	0.09	2.32	0.78	2.37	8.15	2.37	9.02	7.06
Goulburn River	0.07	1.49	0.81	1.29	2.88	1.65	3.76	4.43
Campaspe River	0.04	1.32	1.04	1.13	2.97	1.86	4.05	4.31
Loddon River	0.03	1.10	1.40	0.91	2.37	1.30	3.80	3.31
Avon and Richardson Rivers	0.03	0.92	0.53	0.69	2.18	0.96	2.74	2.57
Avoca River	0.01	0.91	0.65	0.67	2.04	1.17	2.70	2.75
Western Wimmera ..	0.09	0.99	0.47	0.52	1.93	0.94	2.49	2.45
Eastern Wimmera ..	0.06	1.25	0.82	0.66	1.99	1.18	2.87	3.09
Mallee Country	0.03	0.88	0.65	0.76	2.22	0.87	2.90	2.51
The whole State	0.12	1.67	0.70	1.32	3.76	1.58	4.58	4.57

* Figures in these columns are subject to alterations when the complete number of returns for March has been received.

P. BARACCHI,
Government Astronomer.

Perishable and Frozen Produce.

QUARTERS ENDED 31ST MARCH, 1906 AND 1905 RESPECTIVELY.

Description of Produce.		Exports from the State.		Deliveries from the Government Cool Stores.	
		1906.	1905.	1906.	1905.
Butter	lbs.	12,018,622	9,468,848	8,415,288	6,684,496
Cheese	"	211,200	320,040	20,543	...
Milk and Cream ...	cases	3,923	2,802	383	1,744
Ham and Bacon ...	lbs.	729,520	429,360	...	...
Poultry	head	15,570	11,885	4,109	3,855
Eggs...	dozen	6,390	8,310	16,066	5,424
Rabbits and Hares ...	pairs	1,037,364	1,135,272	508,474	471,377
Mutton and Lamb	carcasses	251,105	90,781	56,501	27,426
Beef	...quarters	2,598	1,291	...	350
Veal	carcasses	1,279	2,645	...	100
Pork...	"	2,456	322	844	315½
Fruit	cases	66,182	66,832	541	1,995
" Pulp	"	1,774	5,442	...	...
Sundries	lbs.	...	...	10,123	55,429

R. CROWE,
Superintendent of Exports.

Fruit, Plants, Bulbs, Grain, &c.

IMPORTS AND EXPORTS INSPECTED DURING THE QUARTER ENDED 31ST MARCH, 1906.

Fruit, &c.	Imports.		Exports.		Fruit, &c.	Imports.		Exports.	
	Australasian.	Oversea.	Australasian.	Oversea.		Australasian.	Oversea.	Australasian.	Oversea.
Apples ...	224	2	1,312	32,797	Raspberries	33	—	—	—
Apricots ...	344	96	1,992	—	Tomatoes...	19,140	—	731	—
Bananas, b/s.	119,415	—	—	—	Plants ...	22	125	28	—
Bananas, c/s.	780	—	1,442	—	Bulbs ...	16	59	14	—
Black Currants	2,938	—	—	—	Barley ...	22,540	—	—	—
					Beans ...	95	30	—	—
Blackberries	461	—	2	—	Copra ...	—	187	—	—
Citrons ...	11	—	—	—	Currants ...	—	750	—	—
Cucumbers	3,048	—	284	—	Figs ...	—	150	—	—
Gooseberries	—	—	1	—	Nuts ...	630	387	—	—
Grapes ...	56	—	394	50	Nutmegs ...	—	123	—	—
Lemons ...	3,142	9,691	535	—	Oats ...	6,585	—	—	—
Melons ...	1,141	—	77	—	Oil-cake ...	—	12,008	—	—
Mixed fruits	181	152	7	—	Onions ...	—	241	—	—
Nectarines	—	—	192	—	Peas ...	—	1,195	—	—
Oranges ...	1,123	6,059	101	—	Potatoes ...	975	11	—	—
Passion fruit	374	—	88	—	Rice ...	—	52,690	—	—
Peaches ...	—	—	1,831	61	Seeds ..	7,401	2,864	—	—
Pears ...	50	—	4,603	1,904	Wheat ...	—	—	—	—
Persimmons	254	—	—	—	Yams ..	—	172	—	—
Pineapples	26,919	—	787	—					
Plums ...	14	—	2,637	—					
Quinces ...	—	—	5	—	Totals ...	217,912	86,992	17,063	34,812

J. G. TURNER,
Inspector, Vegetation Diseases Acts, and Exported Products Act.

THE JOURNAL

OF

The Department of Agriculture.

Vol. IV. Part 6. 8th June, 1906.

SOME OBSERVATIONS ON THE EXPORT SEASON 1905-6.*

R. Crowe, Superintendent of Exports.

The butter export season now drawing to a close has been both peculiar and interesting. Perhaps never before in the history of the export trade have all the good and bad points of the industry appeared in such bold relief within the one season. The course of supplies and prices, the expectations and fears of the last sixteen years, have all been manifested in this one In short, it may be termed a summary of all the preceding seasons, with promise of a satisfactory ending. At the end of the first three months it appeared certain that we were going to have a record output, but through October and November cold weather prevailed, and these pleasant anticipations were not fulfilled. In fact, production for a time fell behind the output of the year before, notwithstanding the good start made. Then by the middle of January the prospects had once more reached a most promising stage, only to be shattered within a month afterwards owing to the absence of rain. Finally, just when the outlook was very blue—in March—good rains came, and now what may be termed a supplementary season is being enjoyed, and butter is being exported in quantity to Great Britain—a circumstance never before experienced in the month of May. So far, 16,733 tons have been shipped to all destinations since the 1st July, 1905, and it appears certain that by the 30th June this total will have reached 17,200 tons—a record season.

Prices.

A phenomenal market ruled through the main part of the year. The average c.i.f. value comes out at 107s. 6d., so that £1,849,000 will be the approximate total for the whole season's butter. (The Swanpool and Moorngag Company reports an average price of 112s. 2d. for the season, and doubtless many other leading factories have secured equally satisfactory results.)

From a dairyman's point of view no previous season has proved so profitable, chiefly on account of the abnormally high prices which ruled on

* Paper read at the Thirteenth Annual Conference of the Australasian Butter Factories' Managers Association, held May, 1906, at Melbourne.

the English market, and the savings effected in transit and marketing. These circumstances alone are responsible for a gain approaching a quarter of a million pounds sterling, a result with which our dairymen cannot but be well satisfied.

THE CHIEF LESSONS.

The season at three periods so full of promise, and on the other hand at times equally desponding, again emphasizes in a most marked manner the necessity for rational feeding and better treatment of dairy cattle. Most of our dairymen are still almost at the mercy of climatic conditions. It rains, and there is plenty of feed and milk; it ceases to rain, the pastures become parched, and the supply is diminished. With a stretch of even moderately dry weather stock die off, all of which prove that there is still great scope for the conservation of water, the growing of green fodders, and the accumulation of reserves against the time of scarcity.

Although some progress has taken place in regard to ensilage, it can hardly be claimed that even the fringe of the subject has been more than touched.

OCEAN TRANSIT.

A duplicate weekly service has been available to shippers since October last, the contract steamers comprising those of the White Star, Aberdeen, and Lund lines, and the mail companies. The rate of freight was only just half of what it had been, and the conditions provided in regard to temperature were better than ever before. Experiments have been conducted with automatic self-registering thermometers. Their utility is patent, and so far everything points to their general adoption. On the steam-ship *Suevic* during her second last voyage one of these instruments was placed in the butter hold. After the fifth day from leaving Melbourne the indicator showed a temperature of 10-12 degrees, which remained constant throughout the voyage. The instrument was set at the London end, and put in the ship's stores cool chamber on the last outward trip, when the record showed a daily rise and fall of many degrees, corresponding exactly with the fluctuations consequent upon the regular opening and use of such a freezing-room. Therefore, from a shipping point of view, the season marks a distinct advance. True, the deliveries in London by the contracting companies were not as regular as could be desired, but it is confidently expected that this will be overcome.

QUALITY.

The quality of the butter exported shows a slight improvement on the previous year, owing to the favorable weather experienced. Not only were abnormal rates realized for choice butters, but even those of an inferior quality brought prices far beyond their relative intrinsic value. My experience is that when this occurs many managers relax their efforts to manufacture up to a high standard. As in previous years, all butter was examined, and its quality noted, prior to export. The following table shows butter classified according to its source, under the heading of "Country Co-operative," "Proprietary and Private," and "Milled and Miscellaneous," "Country Co-operative" meaning the output of co-operative butter factory companies outside the city, "Proprietary and Private" that exported by proprietary companies and private individuals having factories both in the country and city, and "Milled and Miscellaneous" including all nondescript parcels shipped by city exporters.

SEASON 1905-06.

Points: Max 100.	Country Co-operative. No. of Cases.	Country Co-operative. Per cent.	Proprietary and Private. No. of Cases.	Proprietary and Private. Per cent.	Milled and Miscellaneous. No. of Cases.	Milled and Miscellaneous. Per cent.
98	52,644					
97	42,543		394		38	
96	39,313		1,807		398	
95	42,700		12,723		3,277	
94	60,661		33,912		5,253	
93	37,076		22,200		4,260	
92	65,386		19,646		2,384	
91	8,365		6,726		851	
90	6,467		12,465		1,137	
Total, 1st Grade	355,155	97·31	109,873	83·52	17,598	51·58
89	2,964		5,376		1,030	
88	1,577		3,697		811	
87	836		2,421		268	
86	913		1,379		980	
85	658		1,492		1,321	
84	335		1,447		810	
83	669		1,901		1,396	
82	637		1,164		1,734	
81	240		623		1,263	
80	69		309		2,136	
Total, 2nd Grade	8,898	2·43	19,809	15·05	11,749	34·44
79	231		631		1,989	
78	240		214		71	
77	126		413		797	
76	59		103		788	
75	152		35		67	
74	23		218		805	
73	..		..		45	
72	35		204		19	
71	..		38		104	
70	..		...		80	
Total, 3rd Grade	866	·23	1,856	1·41	4,765	13·96
69	33		...		...	
68	12		...		...	
Total, Pastry	45	·01	...		...	
Totals ...	364,964		131,538		34,112	

Grand total, 530,614.

Co-operative Factories.	Proprietary and Private.	Milled and Miscellaneous.
Total Cases, 364,964 = 68·78 %	Total Cases, 131,538 = 24·78 %	Total Cases, 34,112 = 6·42 %

Grand total, 530,614.

GRADING AND STAMPING.

Some two seasons ago 22 factories had their butter graded and stamped voluntarily. Last season there were 67 factories, whilst for this, butter factories and exporters representing over 90 per cent. of the output have given written instructions to the Department to grade and stamp their butter for export. From the foregoing table it will be seen that 97.3 per cent. of the country co-operative butters was first grade, 2.43 per cent. second grade, and 0.23 per cent. third grade. Proprietary and private exporters gave a result of 83.52 per cent. first, 15.05 per cent. second, and 1.41 per cent. third grade; whilst milled was down to 51.58 per cent. first, 34.44 per cent. second, and 13.96 per cent. third grade.

Everyone is familiar with the recent controversy regarding this subject of grading. "To grade or not to grade, that is the question." Now, it seems to me that the "Country Co-operative" dairymen have little or no reason to oppose grading, whilst they have everything to gain. The "Proprietary and Private" manufacturers may have grounds for opposition, and it can easily be conceived that those interested in nondescript parcels are naturally against it. That the grading and grade stamping of butter for export has a marked educational influence on manufacturers and producers is evidenced by the experience of New Zealand. Four years ago the percentage of "creamery" butter, first grade, was 95.94 per cent., second 4.0 per cent., and third 0.06 per cent.; whilst "dairy" butter showed first 73.20 per cent., second 25.58 per cent., third 1.2 per cent.; and "milled," first 68.48 per cent., second 30.14 per cent., third 1.38 per cent. Two years ago the quantity of first grade "creamery" butter exported was 97.27 per cent., while for the year ended 31st March, 1906, 98 per cent. of the "creamery" butter was first grade, "dairy" butter showed 82 per cent. first grade, whilst "milled" was down to 70 per cent. This improvement is accentuated when it is remembered that a higher standard is set for the grades each year.

The recent bold effort to secure the aid of country dairymen and butter factories in opposing the extension of grading is very significant. Can any one imagine New Zealand dairymen interested in "creamery" butter taking vigorous steps to have the shippers of nondescript parcels placed on the same footing as themselves?

IS MELBOURNE THE PROPER PLACE TO MANUFACTURE VICTORIA'S BUTTER?

During the last two years, notwithstanding the findings of the Butter Board and the Royal Commission on the subject, the proportion of cream supplies coming to Melbourne for manufacture is on the increase. For the first four months of 1906 6,171½ tons net of butter reached Melbourne, against 2,201 tons net of cream, so that the latter amounts to 35½ per cent. in weight of the former, compared with 6,489 tons of butter for the same period in 1905, and 1,335 tons of cream, or 20½ per cent. Although the butter arrivals show an advance of 5 per cent. cream deliveries have increased by 65 per cent. On making a comparison of the last six months with the corresponding six months of the year before, and of the last twelve months with the corresponding twelve months, the increase appears gradual and to be making regular headway.

This movement has a close relationship to the question of grading and grade stamping of butter exports, and the recent action of some of those who

are so strenuously opposing the system. It has already been proved that country-made butter is better than that manufactured in the city, and it should be obvious to all producers which side to take.

Value of Inspection.

It was found necessary during the season, not only to take further action regarding the quantity of moisture and boric acid contained in butter, but with regard to the matter of short weights also.

The percentage of moisture in Victorian butter is materially increasing, and, notwithstanding the action of the Department in previous years in reference to boric acid, stringent measures had again to be resorted to. For the first time the Department took a firm stand in connexion with short weights. Certain factories were written to in the height of the season, and recommended to improve their packing. After being cautioned a number of times, the Department finally stopped branding or shipping their butter. The principle being once established, "fish cannot be made of one and fowl of another," and, therefore, all butter short in weight is promptly stopped, and will not be branded by the Department for export.

Some idea may be gained of the delinquencies of butter factory managers when the fact is stated that consignments amounting to 133 tons were found to be short in weight, 28 tons excessive boric acid, and 5 tons with moisture beyond the maximum of 16 per cent.

Pure Cultures.

During the season twelve butter factories used pure lactic acid cultures, which were prepared at the University laboratory and issued as required. It is noteworthy that in all the factories, with one exception, where there has been an improvement in quality, they were handling milk supplies exclusively; whilst with those in which the opposite occurred they were, with a single exception, dealing either partly or entirely with home separator cream. Grouping half-a-dozen of the latter factories and six of the former class, it is found that the average points in the cream supply class were 94.74 points for 1904-5, and 94.16 points for 1905-6, or a depreciation of .58 points. With the milk supply factories using the ferments, the average gained for 1904-5 was 96.00 points, and for 1905-6 96.54 points, or an increase of .54 points. Since in five cases out of six of the milk-supplied factories a distinct improvement was effected, it may reasonably be concluded that, where managers have full control of their supplies, the use of pure cultures is undoubtedly advantageous.

Instruction.

Since this time last year special University classes were held, and a practical course provided at the Cobden butter factory. Many butter factory managers and dairy students availed themselves of these facilities, and in every case, I believe, the result was a material gain both to themselves and the companies with which they were concerned.

Similar opportunities are being afforded this year, and it is gratifying to find such a large number enrolled, notwithstanding the fact that fees have been charged.

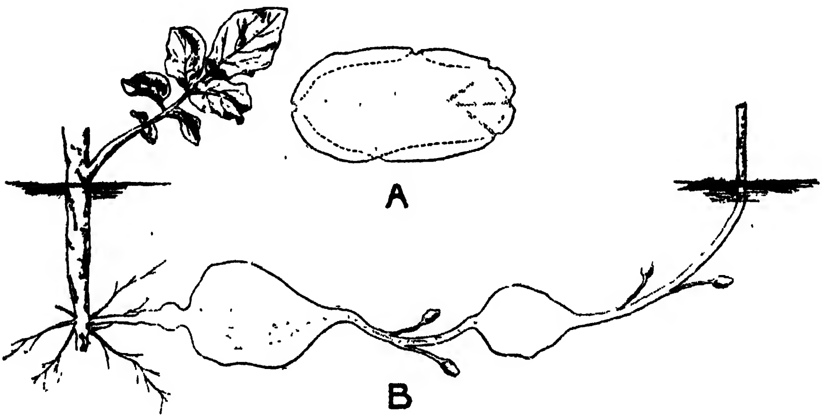
SELECTION OF SEED POTATOES.

George Seymour, Potato Expert.

There can be no doubt that the want of care in the selection of seed has in the past had a great deal to do with the inferior quality of many of the potatoes placed on the market, and also with the unremunerative returns to the farmer. The trouble has come about from want of knowledge on the part of many growers, as well as want of care, as they fail to discriminate between the wild potato and the true one.

DESCRIPTION OF THE WILD POTATO.

Every writer on the potato describes the tuber as a thickened underground branch. Balfour, in his *Manual of Botany*, describes the tuber



INTERNAL STRUCTURE OF POTATO.

A. Cultivated Potato. B. Wild Potato.

as a thickened stem or branch, produced by the approximation of the nodes and the swelling of the internodes. This is strictly correct of the potato in its wild state, but only partly so of the plant when highly cultivated. If the wild potato be cut through the centre into two halves, from the crown to the stem end, the internal structure will be found quite different from that of the true potato. The core or centre of the wild tuber preserves a branch-like appearance right through, throws out a branch at the crown end, and forms another tuber, and so on till the last one may be two feet away from the parent plant, or the last stem may force its way up through the ground and produce a plant as shown in the illustration—(Fig. B). It is not so with a true potato, which, if cut through the centre, will show that the corticle layer surrounds the whole tuber (Fig. A), and is only pierced by a core line where the buds or eyes are found, and that all these lines proceed from the centre core, and are the channels along which the starch travels when a tuber throws out its shoots or buds. This outside layer is very poor in starch, and when these core lines do not pierce that layer it gives rise to what is known as cottony-eyed or blind seed, so often met with in Gippsland potatoes.

The wild plant in the accompanying illustration shows a number of stringy tubers, mentioned before, and also one fairly large one, with several small ones attached to it by short stems; these are not prongs, but separate tubers. In raising new varieties from seed, no effort is spared to get rid of all plants which show the slightest tendency to produce strings. In some cases not more than one plant out of a hundred is found to produce true potatoes, and even the produce of some of the tubers from this plant may in the following season be found to produce a wild strain. Consequently, it takes a long time before the type of a new variety is fixed, and it is ready to put on the market. There can be no doubt that many of the new varieties during the late potato boom were placed on the

THE WILD POTATO.

FLAT TOP OF "TASMANIAN RED" POTATO.

market before the type was fixed. The question is often asked: Why do potatoes run out? The same question may be asked in regard to the horse, sheep, or any animal the type of which is kept up to the standard by careful selection and breeding. The same answer applies to the potato.

SELECTION OF SEED.

In the September *Journal* reference was made to the bloom of the plant as a means of distinguishing the true from the wild potato. In this article an effort will be made to give such a description of the bloom, aided by illustrations, and the foregoing description of the characteristics of the wild plant and tuber, that will, it is hoped, enable any one exercising

ordinary observation to know the wild potato. The careful study of the bloom has another and very important use, viz., it assists in the identification of variety.

THE BLOOM.

Potato plants may be divided into two sections—those that have white and those that have coloured flowers. The latter are purple, varying from a dark to a very pale shade, and some a tinge of pink. These shades are represented generally by the following varieties:—Dark purple, Coronation; medium purple, Up-to-date, Daniel's Sensation, and others; pale purple, Brown's River, Flat-top, Scotch Grey. It must be remembered that the shade of all these vary slightly in different soils, and also in the age of the bloom. In a few days it loses its colour, and by the time it falls has faded to a dirty white, and at this stage is very liable to be mistaken for the flower of the wild plant. It should also be remembered that many of the white-skinned potatoes have a purple flower, others have a white, such as the Beauty of Hebron, Carman No. 1, British Queen, Sir John Llewellyn, Ashleaf, and Lapstone. Kidney, The Rose, and Vermont also have a white bloom.

STRINGY GROWTH OF WILD POTATO.

To know a wild potato by the flower, it is first of all necessary that one should know the flower of the variety. As a guide, it may be stated that when a plant which should have a coloured flower produces a white one, it is a sure sign that the plant is running out, and, although it may produce a very fair sample of potatoes, it will not long continue to do so. The difficulty arises when we consider the varieties which have a white flower. The wild one here shows a very slight difference, and can only be identified after long experience. The variety known as Flat-top has another strain, which requires to be culled out, viz., the plants which produce a very broad, flat stalk, varying from one to three inches. These produce one or two large, unshapely tubers for a season or two; but, if planted continuously, will yield a poor return, and should be got rid of as quickly as possible. The first evidence of degeneration is manifested in the plant by the flower cluster forming at the top of the haulm, in the form of a green knob or tassel, but no blooms ever appear. The tubers themselves can be detected, when selecting seed, by examining the crown, as the eyes run across it in the form of a crease, and when throwing out the crown shoot it is quite flat. Some growers have made it a practice to select these, thinking the flat haulm a characteristic of the variety, but this is a mistake. An illustration of this undesirable strain appears on the preceding page.

R S Brain, Govt Printer

1. Brown's River true bloom. 2. Brown's River wild bloom
3. Uptodate 4. Coronation

POTATO BLOSSOMS.

The weeding out of the wild blooms is only practicable when the standard of the crop is high, and the percentage of wild plants small; but it very often happens that more than one-fourth of the plants are wild. In some cases it has been found that more than 60 per cent. were below the standard. Many of these would produce tubers fit for market, and in a favorable season, on good land, would produce a very fair crop; but, nevertheless, it is essential that they should be got rid of. The best

PRODUCE OF 67 PLANTS, TRUE "TASMANIAN RED"—97½ LBS., 11 LBS WASTE.

plan would be to leave them till the digging time, and then select seed only from the best stools. The crop raised from this seed should be carefully watched during the next blooming season, and all wild plants pulled up. One point must be borne in mind: It is not enough to go through them once or twice, as all the plants do not bloom at the same time. After a fall of rain is a very favorable time. There must be no delay, as the coloured bloom soon fades; it has a dirty-white appearance, and may be mistaken for a wild plant. If the standard of the crop is to be maintained, the work must be attended to every year; but there is the satisfaction of knowing that the more thoroughly the work is done the lighter will

PRODUCE OF 131 PLANTS, WILD "TASMANIAN RED"—
106 LBS., 60½ LBS. WASTE.

be the task next year, until, from being a considerable undertaking, it will become a pleasure to go through the crop and pull out the unprofitable plants. The questions naturally arise: Will it pay to spend so much time over the crop? and Will the average grower take the trouble? To the former the answer must be "Yes," and to the latter most likely "No."

The accompanying illustrations prove that it will pay. They represent one drill, planted with 198 sets Tasmanian Red. The first is the actual return from 67 plants, which produced 97½ lbs. of potatoes, of which

11 lbs. were waste; and the other is the produce of 131 plants (wild), which gave a gross return of 106 lbs., with 60½ lbs. waste. Of the 198 sets planted, only 35 per cent. proved to be true potatoes, 65 per cent. being wild. About half the latter were of the flat-stalk strain mentioned above, and produced nearly all the large potatoes. In the second photograph, the white-bloom wild plant was responsible for nearly all the small ones. A glance at the illustrations should be sufficient to convince the most sceptical that there is a great deal more in the selection of seed than a mere fad. The figures are more striking. Had the whole drill been planted with good seed, it would have returned a fraction over 249 lbs. of marketable and seed potatoes, or a crop equal to 5 tons 1 cwt. 0 qrs. 24 lbs. As it was, the actual return was 130 lbs. of marketable tubers, many of which were only of medium quality, or 2 tons 12 cwt. 0 qrs. 26 lbs., a loss of 2 tons 8 cwt. 3 qrs. 26 lbs., which, at £5 10s. per ton, the market price at the time of digging, represents a money loss of £13 11s. per acre. These are actual facts. There is no guess-work about it, as the tests were carried out when the crop was dug, and weighed in the field. The variety mentioned, Tasmanian Red, is also known as Flat Top.

These facts should go a long way to stirring farmers up to the necessity of more careful attention to the selection of seed. The average grower may not take the trouble with his seed, preferring to market his crop and buy seed for next season. The result will be that the growers will naturally divide themselves into two groups. The few in the cooler districts of the State will become the raisers of superior strains of seed potatoes, which can be relied upon, and the many, comprised in all the districts, who will grow for local consumption and the export trade. In this way the standard of our potato crop will be greatly improved, and the industry become more profitable.

INOCULATION.

Much has been said about raising new varieties by inoculation, crossing one variety of potato with another. This is done with a view to improve either the yielding or cooking quality of the potato by crossing a gross-yielding potato of lower cooking quality with a light-yielding variety of good cooking quality and flavour. The good cooking varieties are, as a rule, light-yielding. In this case, some quality has to be sacrificed to obtain a heavy cropping variety. This method of obtaining a new variety entails an immense amount of work and careful observation. In order to carry out the work successfully, the plant that is to bear the berries must be carefully watched, and as soon as the flower opens have the anthers removed, to prevent self-fertilization. Then the other variety which is to be used for crossing must bloom at a suitable time, and have the pollen ready for fertilization, otherwise the operation will be a failure. There can be no doubt that many of the varieties to which new names are given are simply sports of well-known sorts. For example, the late or long Top Rose springs from the Early Rose. There is also a late strain in the Carman and the Hebron, and in many other varieties. They can always be distinguished by their robust stalks and habit of ripening late. The tubers are generally larger and of coarser appearance, though often of very good quality.

SUPPLEMENTARY LIST OF ARTIFICIAL MANURES forwarded from time to time to the Chemist for Agriculture for Analysis, as required by Section 4 (Sub-sections 1 and 2) of the *Artificial Manures Act Amendment Act* 1905.

SUPPLEMENTARY UNIT VALUES LIST, SEASON 1906.

Description of Manure	Moisture Per-centage	Nitrogen. Per-centage.	Nitrogen. Estimated Value in One ton of the Manure £ s. d.	Phosphoric Acid. Water Soluble Per-centage.	Water Soluble Estimated Value in One ton of the Manure £ s. d.	Citrate Soluble Per-centage	Citrate Soluble Estimated Value in One ton of the Manure. £ s. d.	Insoluble Per-centage	Insoluble Estimated Value in One ton of the Manure £ s. d.	Total Per-centage	Total Estimated Value in One ton of the Manure £ s. d.	Estimated Total Value of Manure per ton £ s. d.	Price asked for Manure per ton Delivered at Local Railway Station £ s. d.	Where Obtainable.
Blood Manure	13.84	8.65	4 15 1									4 15 1	4 10 0	Mt Lyell M. and R. Coy., Melbourne
Sulphate of Ammonia		20.70	14 16 8									14 16 8	14 10 0	Metropolitan Gas Coy., Melbourne
" "		20.79	14 17 11									14 17 11	14 10 0	The Sheaf Brand Artificial Manure Coy., Melbourne
Nitrate of Soda		16.21	12 11 3									12 11 3	12 0 0	" " " "
Superphosphate, No. 1, Anchor Brand	10.60			17.80	4 0 1	1.80	0 7 2			19.60	4 7 3	4 7 3	4 5 0	Colonial Manures Coy., Melbourne
" No. 2, Anchor Brand	14.00			13.09	2 18 10	1.98	0 7 11			15.07	3 6 9	3 6 9	3 15 0	" " " "
" Concentrated	10.19			40.91	9 4 1	4.81	0 19 2			45.12	10 3 3	10 3 3	12 10 0	
" Ovens Improved	14.36			16.51	3 14 3	1.85	0 7 4			18.36	4 1 7	4 1 7	4 5 0	Strachan, Murray, and Shannon, Melbourne
" Extra dry	3.17			21.03	4 14 7	.97	0 3 10			22.00	4 18 5	4 18 5	4 7 6	A. H. Hasell, Queen-street, Melbourne
" Hasell's "Jap"	6.45			18.88	4 4 11	1.65	0 6 7			20.53	4 11 6	4 11 6	4 5 0	" " " "
" Concentrated	12.33			38.18	8 11 9	5.98	1 3 11			44.16	9 15 8	9 15 8	12 10 0	The Sheaf Brand Artificial Manures Coy., Melbourne
" Special	4.21			21.65	4 17 5	.97	0 3 10			22.62	5 1 3	5 1 3	4 10 0	" " " "
" Ordinary	10.66			14.32	3 4 5	3.07	0 12 3			17.39	3 16 8	3 16 8	4 5 0	" " " "
" Concentrated	10.43			41.35	9 6 0	3.40	0 13 7			44.75	9 19 7	9 19 7	12 10 0	Renard Fertilizer Coy. Prop. Ltd., Melbourne
Star Phosphate						14.90	2 19 7	5.83	0 17 5	20.73	3 17 0	3 17 0	4 0 0	Colonial Manures Coy., Melbourne
Nitro Superphosphate, Anchor Brand	9.80	1.14	0 10 10	8.63	1 18 9	3.15	0 12 7	5.39	0 16 6	17.28	3 7 10	3 18 8	5 0 0	" " " "
Bonedust and Superphosphate No. 1.	6.92	1.30	0 12 4	14.00	3 3 0	4.02	0 16 0	4.64	0 13 11	22.66	4 12 11	5 5 3	5 0 0	Mt Lyell M. and R. Coy., Melbourne
Bone Superphosphate	8.34	3.24	1 10 9	4.62	1 0 9	5.62	1 2 7	9.97	1 9 10	20.21	3 13 2	5 3 11	6 0 0	Wischer and Co., Melbourne

SUPPLEMENTARY UNIT VALUES LIST, SEASON 1906—*continued.*

Description of Manure.	Moisture. Percentage.	Nitrogen. Percentage	Nitrogen. Estimated Value in One ton of the Manure.	Phosphoric Acid. Percentage.	Phosphoric Acid. Estimated Value in One ton of the Manure.	Mechanical Condition. Percentage of Fine Bone.	Mechanical Condition. Percentage of Coarse Bone.	Mechanical Condition. Nitrogen. Percentage in Fine Bone.	Mechanical Condition. Nitrogen. Percentage in Coarse Bone	Mechanical Condition. Phosphoric Acid. Percentage in Fine Bone	Mechanical Condition. Phosphoric Acid. Percentage in Coarse Bone.	Estimated total Value of Manure per ton	Price asked for Manure per ton Delivered at Local Railway Station	Where Obtainable.
			£ s. d.		£ s. d.							£ s. d	£ s d	
Bonedust (Anchor Brand) ..	4.99	4.23	2 2 9	19.54	3 10 0	52 02	47 98	1.78	2.45	11.49	8.05	5 12 9	6 0 0	Colonial Manures Coy., Melbourne
„	4 80	2 27	1 2 3	5.95	0 18 6	83 59	16.41	0.51	1.76	0.79	5 16	2 0 9	4 0 0	John Adams, Doreen
„ (Plough Brand) ..	6.02	4 19	2 2 3	23.12	3 18 8	41.02	58 98	1.67	2.52	9 43	13.69	6 0 11	5 10 0	E. T. Hoskin, Bairnsdale

SUPPLEMENTARY LIST SHOWING RESULTS OF ANALYSES OF SAMPLES OF ARTIFICIAL MANURES COLLECTED THROUGHOUT THE STATE, UNDER THE PROVISIONS OF THE ARTIFICIAL MANURES ACT 1905.

Description of Manure.	Manufacturer or Importer.	Moisture. Found.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Water Soluble. Found.	Water Soluble. Guaranteed.	Citrate Soluble. Found.	Citrate Soluble. Guaranteed.	Insoluble. Found.	Insoluble. Guaranteed.	Total. Found.	Total. Guaranteed.	Estimated Value per ton.
		%	%	%	%	%	%	%	%	%	%	%	£ s. d.
Thomas Phosphate	Cuming, Smith, and Coy., Melbourne	.	..	..	..	..	14.55	..	4.67	..	19.22	17 00	3 12 2
„ „	„ „ „	.	..	.	..	..	15.70	..	1.63	..	17.33	17.00	3 7 7
Superphosphate	W. P. Shaw, Olderfleet, Melbourne	8 00	..	..	19.13	18.00	1.76	1.50	0 45	1.50	21.34	21.00	4 13 5
Superphosphate, No. 15 ..	Australian Explosives and Chemical Coy., Melb.	2.94	..	..	12.78	13.20	3.59	0.20	1.68	1.10	18.05	14.50	3 13 6
Superphosphate, Ordinary ..	„ „ „	3 78	..	..	18.70	18.00	3.49	1.50	0.58	1.50	22.77	21.00	4 18 6
Superphosphate	Colonial Manures Coy., Melbourne	8.50	..	.	17.53	17.50	2.78	1.00	0.65	..	20.96	18.50	4 10 6
„	„ „ „	11 00	..	..	17.13	17 50	1.80	1.00	.	..	18.93	18.50	4 4 3
Thomas Phosphate	„ „ „	.	.	..	..	..	15.22	14 00	6 34	3.00	21.56	17.00	3 19 10
„ „	„ „ „		..	.	..	..	15.55	14.00	4.73	3.00	20.28	17.00	3 16 5
„ „	„ „ „		..	.	.		14 91	14 00	3.57	3.00	18.48	17.00	3 10 3

SUPPLEMENTARY LIST SHOWING RESULTS OF ANALYSES OF SAMPLES OF ARTIFICIAL MANURES.—*continued.*

Description of Manure.	Manufacturer or Importer.	Moisture. Found.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Water Soluble. Found.	Water Soluble. Guaranteed.	Citrate Soluble. Found.	Citrate Soluble. Guaranteed.	Insoluble. Found.	Insoluble. Guaranteed.	Total. Found.	Total. Guaranteed.	Estimated value per ton. £	s.	d.
		%	%	%	%	%	%	%	%	%	%	%			
Superphosphate, Standard Flag Brand	Renard Fertilizer Coy. Propy. Ld., Melbourne	9.65	..	.	17.56	17.00	2.93	1.50	0.76	0.50	21.25	19.00	4	11	5
" " " "	" " "	10.74		..	17.22	17.00	1.81	1.50		0.50	19.03	19.00	4	4	9
" " " "	" " "	..	.	.	17.41	17.00	3.11	1.50	0.65	0.50	21.17	19.00	4	11	5
" " " "	" " "	9.26	.	..	16.42	17.00	2.84	1.50	0.51	0.50	19.77	19.00	4	5	8
Superphosphate, Standard B Flag Brand	.. " "	9.13		..	11.36	12.75	2.36	1.30	0.74	0.24	14.46	14.29	3	1	3
Thomas Phosphate, Standard Flag Brand	" " "	..	..	.	..	..	14.11	13.17	4.59	4.00	18.70	17.17	3	10	2
" " " "	" " "	.	.	.	..	..	14.27	13.17	4.33	4.00	18.60	17.17	3	10	0
Star Phosphate, Standard "Flag Brand	" " "	..		.	..		14.48		3.25	.	17.73	17.00	3	7	8
Bonedust and Superphosphate, Standard Flag Brand	" " "	9.67	1.26	0.90	12.09	12.75	3.48	4.25	3.47	2.31	19.04	19.31	4	11	5
" " " "	" " "	9.41	0.98	0.90	13.36	12.75	3.15	4.25	2.49	2.31	19.20	19.31	4	10	1
" " " "	" " "	8.25	1.45	1.20	9.03	10.20	4.22		5.95	9.10	19.20	19.30	4	10	1
Superphosphate, No. 1 ..	Mount Lyell M. and R Coy., Melbourne	10.62	..	..	19.78	18.50	3.12	1.25	..	1.20	22.95	20.75	5	1	5
" " ..	" " "	9.12	.	.	19.62	18.50	1.45	1.25	0.77	1.00	21.84	20.75	4	14	9
" " ..	" " "	9.47	..	..	19.50	18.50	1.32	1.25	1.27	1.00	22.09	20.75	4	14	3
Superphosphate, No. 2 ..	" " "	10.31	..	..	17.95	17.00	0.19	0.75	1.96	0.75	20.10	18.50	4	3	5
Superphosphate, Wischer's .	Wischer and Coy., Melbourne	7.17	..	..	17.84	18.00	1.52	1.50	1.64	1.50	21.00	21.00	4	7	11
" " ..	" " "	8.30		..	18.16	18.00	0.81	1.50	1.68	1.50	20.65	21.00	4	6	6
Superphosphate, Florida ..	Cuming, Smith, and Coy., Melbourne	9.73	.	.	19.09	18.00	2.04	1.50	0.80	1.50	21.93	21.00	4	14	9
" " .	" " "	8.95	..		18.44	18.00	1.00	1.50	1.48	1.50	20.92	21.00	4	8	4
" " ..	" " "	10.46	.	..	18.92	18.00	1.37	1.50	1.20	1.50	21.49	21.00	4	11	8
" " .	" " "	10.60	.	..	18.06	18.00	1.20	1.50	1.27	1.50	20.53	21.00	4	7	3
" " ..	" " "	10.10	..	.	19.17	18.00	0.65	1.50	0.86	1.50	20.68	21.00	4	9	8
Bonedust and Superphosphate ..	" " "	7.46	1.77	1.50	9.19	7.50	6.22	5.00	7.55	8.00	22.96	21.00	5	6	10
Superphosphate, Nitro .	" " "	14.36	0.96	1.00	10.65	10.01	3.35	3.88	5.76	5.48	19.76	19.37	4	8	5

Supplementary List showing Results of Analyses of Samples of Artificial Manures—*continued.*

Description of Manure.	Manufacturer or Importer	Moisture. Found.	Nitrogen. Found.	Nitrogen. Guaranteed	Phosphoric Acid. Water Soluble. Found	Water Soluble. Guaranteed	Citrate Soluble. Found	Citrate Soluble. Guaranteed	Insoluble Found	Insoluble Guaranteed	Total. Found	Total. Guaranteed.	Potash. Found	Potash. Guaranteed.	Estimated Value per ton.
		%	%	%	%	%	%	%	%	%	%	%	%	%	£ s. d.
Superphosphate No. 1	Mt Lyell M. and R Coy., Melbourne	10.48	..	..	20.02	18.50	1.38	1.25	0.74	1.00	22.14	20.75	..	..	4 16 0
" "	" "	11.04	..	..	19.75	18.50	1.65	1.25	..	1.00	21.40	20.75	..	..	4 15 5
" "	" "	11.15	..	..	20.15	18.50	2.30	1.25	0.76	1.00	23.21	20.75	..	..	5 0 6
" "	" "	8.72	..	..	20.30	18.50	2.91	1.25	..	1.00	23.21	20.75	..	..	5 2 11
Superphosphate, Nitro	" "	9.62	1.68	1.60	17.06	16.00	1.15	1.00	1.06	0.75	19.27	17.75	..	..	5 1 8
Superphosphate, No 1	" "	11.30	..	..	18.96	18.50	1.86	1.25	1.40	1.00	22.24	20.75	..	..	5 1 5
Potato Manure	" "	7.79	1.00	1.00	14.88	15.50	3.78	0.50	0.82	1.00	19.48	17.00	4.20	4.00	5 17 9
Superphosphate, Standard Flag Brand	Renard Fertilizer Coy., Melbourne	9.04	..	..	16.64	17.00	2.72	1.50	0.76	0.50	20.12	19.00	..	..	4 6 5
" "	" "	6.15	..	..	16.64	17.00	3.89	1.50	..	0.50	20.53	19.00	..	..	4 10 4
Superphosphate, Standard B. Flag Brand	" "	7.46	..	..	12.57	13.75	2.82	0.25	0.18	..	15.57	14.00	..	..	3 7 11
Superphosphate, Standard Flag Brand	" "	9.95	..	..	16.20	17.00	3.83	1.50	..	0.50	20.12	19.00	..	..	4 8 6
" "	" "	9.85		..	16.33	17.00	3.73	1.50	..	0.50	20.06	19.00	..	..	4 8 4
Superphosphate, Florida	Cuming, Smith, and Coy., Melbourne	10.86	..	..	19.87	18.00	0.55	1.50	0.21	1.50	20.63	21.00	..	..	4 11 9
" "	" "	8.54		..	19.91	18.00	0.61	1.50	0.48	1.50	21.00	21.00	..	..	4 12 5
" "	" "	9.90	..	..	19.71	18.00	0.42	1.50	0.70	1.50	20.83	21.00	..	..	4 10 8
" "	" "	9.96	..	..	19.57	18.00	1.02	1.50	0.24	1.50	20.83	21.00	..	..	4 12 2
" "	" "	11.99	..	..	18.25	18.00	2.75	1.50	..	1.50	21.00	21.00	..	..	4 13 3
" "	" "	11.58	..	..	19.08	18.00	1.06	1.50	1.12	1.50	21.26	21.00	..	..	4 11 1
Superphosphate and Bonedust	" "	7.02	1.40	1.50	9.57	7.50	5.57	5.00	5.98	8.50	21.12	21.00	..	..	4 17 6
Superphosphate, Nitro	" "	9.51	1.05	1.00	11.04	10.01	4.72	3.88	5.76	5.48	21.52	19.37	..	..	4 16 7
" "	" "	7.36	0.93	1.00	9.88	10.01	4.21	3.88	6.94	5.48	21.03	19.37	..	..	4 11 7
Potato Manure	" "	6.90	1.00	1.00	15.70	8.21	2.18	3.63	1.83	5.53	19.71	17.37	5.22	5.20	6 3 4
Superphosphate, Wischer's	Wischer and Co., Melbourne	6.46	..	..	17.76	18.00	1.60	1.50	2.91	1.50	22.27	21.00	..	..	4 9 6
" "	" "	6.35	..	..	18.39	18.00	1.71	1.50	2.17	1.50	22.27	21.00	..	..	4 11 9
Superphosphate, Federal O S	Australian Explosives and Chemical Coy., Melbourne	8.77	..	..	19.18	18.00	1.36	1.50	1.60	1.50	21.14	21.00	..	..	4 13 3
" " "	" " "	7.51	..	..	18.04	18.00	2.62	1.50	0.90	1.50	21.56	21.00	..	..	4 12 5
Market Garden Manure, No. 2	" " "	5.87	2.01	1.50	12.32	10.70	2.35	0.20	0.80	1.10	15.47	12.00	3.75	3.50	5 18 4
Superphosphate, Soluble (Jap.)	A. H. Hasell, Melbourne	11.23	..	..	18.26	18.50	1.45	1.50	..	..	19.70	20.00	..	..	4 7 11
" " "	" "	10.30	..	..	17.73	18.50	2.52	0.07	..	..	20.32	20.00	..	..	4 9 9
Grass Manure, Anchor Brand	Colonial Manures Coy., Melbourne	3.75	..	..	..	..	10.57	12.60	7.36	2.70	17.92	15.30	1.30	1.25	3 11 4

W. PERCY WILKINSON, Government Analyst and Acting Chemist for Agriculture.

SELECTING AND PLANTING FRUIT TREES.

C. Bogue Luffmann, Principal, Burnley School of Horticulture and Small Farming.

Grow but Few Sorts.

As the quantity of commercial fruit increases the number of species and varieties employed decreases from year to year. This is as it should be, since it would prove impossible to build up a permanent local and oversea trade by means of a great variety of fruit in small parcels. Fruit-growing has been engaged in long enough to indicate what is most suitable and profitable in different soils and situations, and it remains to increase the output of such lines as have, on the whole, given profitable returns.

In rare circumstances, several species and varieties of fruit may be grown, but the best commercial result will always come from adhering to two or three well-chosen sorts.

The leading half-dozen deciduous fruits are apples, pears, plums, cherries, peaches, and apricots. Any one starting a new orchard, or replenishing an old, should rely chiefly on these trees, as their produce is wanted in many markets.

Select according to Soil and Situation.

The first four do best in cool country, whereas the peach and apricot like plenty of heat and a warm and sweet winter soil.

In selecting trees, we should be able to estimate their especial wants, as it is only where their tastes are in keeping with the soil and climate that they thrive and prove profitable over a full life.

Amongst trees of any one species will be found varieties of varying strength of wood and capacity to resist disease, and no choice should be made without learning which are, under all the circumstances, best for a particular soil and situation. By way of example, trees of weakly constitution should never be placed in stiff, dry, and poor soil. Such a soil must be placed under the most robust and hardy kind of tree, if it is to hold its own and yield a profit.

It rarely happens that a piece of ground presents a uniform soil and opportunities throughout. Difference in depth, level, aspect, drainage, and protection from sun and wind, bring about very marked differences in its tree-sustaining powers, and as the resources of the orchard area vary, so should the species or varieties of tree.

Distance to Plant.

In exposed positions protection is an advantage, whilst in confined positions, or shady hill-sides, exposure is an advantage. Thus, trees may require to be planted close together or far apart, according to the amount of protection or degree of exposure they are likely to need. It has been the custom to plant far apart where the soil is at all poor, but this is fundamentally wrong, as the more the soil is exposed the more it will be desiccated and wasted. Fairly close planting is therefore most appropriate where soil is thin, poor, and liable to summer droughts.

Trees should not be planted at varying distances excepting where distinct breaks—as ditches, fences, or double headlands—occur in the orchard, or where there exists a marked difference in the quality of the soil and the kinds of trees chosen. For instance, upright or small-growing trees do not call for so much room as those which grow to large size and spread a good deal. Such apples as "Jonathan," "Five Crown," and "Rokewood" often pay well as semi-dwarfs, standing at no more than 7 or 8 feet in height, and of about the same diameter. Sixteen, 18, or 20 feet, at most, is ample for such trees. Of course, if the soil is really good, larger trees should be encouraged, and then wider planting is necessary.

LENGTH OF TRUNK VERY IMPORTANT.

For all exposed and warm positions, choose short-trunked trees. The shorter the trunk, the more vigorous the resulting branches, and the greater the tree's power of effecting a fair start. The distance between the leaf system and the root system governs the movement and value of the sap. Long-legged trees yield small, weak branches, become stunted, fruit early, and soon decline; whilst short-trunked trees grow vigorously, screen all their wood from the burning summer sun, make even and robust branches, assume a good size, yield the largest possible amount of fruit, and last out a full life.

Long trunks are appropriate only where the position is shaded, the soil rich, cool and moist at all seasons, as here a restricted sap-flow would prove an advantage.

TIME TO PLANT.

Early winter is the best time at which to plant deciduous fruit trees. As soon as the leaves become discoloured, the sap in the roots begins to move more or less actively, and if the soil is kept sweet and warm a free extension of root-growth will take place. The nature and extent of the autumn root-growth governs the behaviour and value of the head-growth in the following year.

When the proper season for planting is selected, the roots commence to grow at once, and no waste or loss of vitality occurs in any part; but if a tree is placed in cold winter soil, and remains stagnant for many months, it not only makes no advance, but actually loses by the rooting of some of its fine roots, and also by means of the drying out of the moisture from the head, which always goes forward at a great pace when the roots are not active.

NATURE OF ROOT GROWTH.

Different species of fruits have varying powers of root-growth, according to the size and vigour of their root systems and the temperature of the soil in which they are placed. Thus, plums, apples, pears, and cherries can root in a much colder season and soil than can peaches and apricots. The former group may, therefore, often be planted in the depth of winter without incurring any injury; whereas the peach and apricot, if forced to endure a cold and wet soil, and with no means to grow at the root, usually die, or become no more than feeble and unprofitable trees.

The number, size, arrangement, and degree of freshness of a young tree's roots at the time of planting go far to determine the value of its

after-life. Fibrous roots are too often sought after. These, being soft and weak, quickly die out, if not confined in a moist packing, and kept away from air. Further, fibrous root systems indicate growth in a light rich soil, and where trees have to face a comparatively poor, stiff, and dry soil, a few stout and well-preserved roots are more capable of getting a grip of the situation than are a number of fibrous ones. These, failing to force their way, stagnate and die; meanwhile, the whole body of the tree languishes, and often fails outright where no strong roots are promoted to replace the feeble and short-lived fibrils.

As before stated, the native vigour of different kinds of trees varies greatly. Thus, a healthy young plum tree, placed in congenial earth, will make substantial roots within a week; whereas a pear, placed alongside, may make no sign in a month. This does not imply that the pear is a feeble-rooting tree; on the other hand, it makes the largest and heaviest root system of all our orchard trees, but it is slow to start when compared with the plum. Knowing how prompt or tardy a tree may be to seize on the soil and secure itself, enables one to decide with certainty on the best time and method of planting.

HOW TO PLANT ACCORDING TO SEASON AND SOIL.

For instance, autumn planting should always be very shallow. The roots should be so near to the surface as to feel the benefit of the warm sun. They will then root promptly, and continue to grow as long as the soil remains warm, moist, and sweet. On the other hand, if planted deeply, covered with a cold or wet mulch, or beneath a flat or airless soil, they will have no power of growing, or even preserving their vitality, till the spring season. In a word, one may say: Plant on the surface to face a cold season (winter), and plant a little deeper to face a hot and drying season (summer).

Autumn planting is best for those trees which can endure the most extreme cold, but those which dislike cold are most successfully planted in spring; of course, much depends on soil and situation. A peach or apricot should be set out in Mildura at the end of May or early in June, whilst the same tree would stand a better chance in Gippsland, or any other cool district, if planted in August or September.

Autumn planting is the best average season for all trees in the North and Central districts of Victoria, but autumn, winter, and spring may prove best for different subjects in the cool South and in the high-hill country. Trees should never be set out in either dry or wet soil. It should be moist, friable, and what gardeners call "kind"—that is, mellow, charged with humus, clean, and sweet. Roots can soon take hold of such material, and grow robust enough to endure the cold of winter. Where possible, water should be used at planting. This does not chill the soil for more than a very short period, whilst it serves to drive out any excess of air, and thereby create the proper rooting medium.

PROTECT AND PREPARE ROOTS BEFORE PLANTING.

When water is not available, the roots of trees should be soaked in a dam or other receptacle for 12 or 24 hours. This is especially necessary where they have been a long time out of the ground, and have been allowed

to get quite dry on their exteriors. If the bark of either root or head is in any way shrivelled, immerse the whole of the tree in water. Sometimes three or four days' immersion helps more than the soaking for a single day, but this must be decided by experience and the power of judging what each tree wants. As a precaution against getting trees in a dried-out condition, state when ordering that they must be thoroughly well packed; also make sure that they are consigned direct, and on your part take prompt delivery, and in all cases drench with water as soon as possible.

THE NURSERY BED.

A well-lighted and mellow strip of soil should be in readiness to receive the trees on arrival, and after the heads and roots have been trimmed of any damaged and straggling wood, they should be planted upright in this nursery bed, then watered, and afterwards have the soil trodden sufficiently firm to make the roots start into even growth. If laid on one side, which is a common practice, the roots grow unevenly, and this leads to a faulty shape in the head of the future tree.

On lifting to plant out, have two or three wet bags or large pieces of canvas, also the most careful hand to lift and transport to where the trees are to be planted. Keep the drying air from the roots as much as possible; plant to a stake driven near the centre of the hole. The soil in the bottom of the hole should be highest in the centre, so that when the tree is placed thereon, its roots slope downwards. Place the first soil over the root points. and tread it firm; then fill up to near the ordinary level, and give a bucket of water; failing this, give a little more soil. In a week or so the trees should be all examined in turn, the soil readjusted, the stakes and ties seen to, and a small gutter cut where there is any danger of water lying about the young tree during winter.

As to weeds, they may either injure or aid the young tree—all depending on its wants in the way of protection or exposure. Where weeds make soil excessively wet and cold, and the tree's roots dislike these, then a clean and weedless surface should be preserved; but in the case of pears, plums, apples, and cherries they are often aided more by a weed-covered soil than by one which grows dry, hard, and bare from exposure to strong winds.

GARDEN NOTES.

J. Cronin, Inspector, Vegetation Diseases Act.

The Chrysanthemum.

The garden chrysanthemum is a descendant of C. Sinense, a Chinese species of hardy, perennial, herbaceous growth. It is recorded that it was first introduced into France in 1789. and the following year was flowered for the first time in England, at the Royal Gardens, Kew. The original importation was purple in colour, and was illustrated in the *Botanical Magazine* of 1796. New varieties were quickly produced from seed; in 1824, 27 distinct kinds were grown in the Horticultural Gardens at

Chiswick. In 1846, Robert Fortune, a plant collector, sent from China the Chusan daisy, the forerunner of the pompon type; and in 1861 sent from Japan plants of the varieties cultivated there.

The chrysanthemum had been cultivated for centuries in Japan, and, though a native of China, had become the national emblem. The types sent by Robert Fortune to England were of very different character to those raised there, being of irregular rugged form, larger and brighter in colour, and altogether weird in comparison with the formal incurved varieties grown in England. Since that time, varieties have occasionally been imported from Japan, among the most notable being "Edwin Molyneux," a grand crimson, and "Mrs. Alpheus Hardy," a white-plumed or hairy variety. For many years chrysanthemums have been raised from seed in vast numbers in England, France, America, and Australia, and better varieties have been distributed than exist in Japan.

Among the many types grown, the class known as Japanese is by far the most popular, on account of its superior size, varied form, and diversity of colour. In Victoria, it is the only class grown to any extent for exhibition, though numbers of the older types are still grown for garden decoration, and for market purposes as cut flowers. The Japanese type embraces a number of very early blooming kinds, largely grown in England for decorative purposes, few, if any, of which are cultivated here. It is possible to have chrysanthemums in bloom here from February, when the early varieties, "Madame Desgrange" and "Lady Fitzwigram," flower, until August, when "Mrs. H. Cannell" and other late flowering kinds can be grown to produce their blossoms. The types are—Japanese; Chinese, or incurved; anemone; pompon; single; and feathery, or thread-petalled, a recent type of small size, valuable for decorative purposes.

Cultivation for Garden Decoration.

There is no plant that will endure such extremes of heat or cold, exposure or shade, as the chrysanthemum. There is none that responds so readily to good culture; a fair amount of root room, plant food, and light insuring a vigorous, free-flowering plant. A single plant, under fair conditions, will produce fully 100 trusses of flowers. For general purposes, the flowers may be thinned or otherwise, according to the taste of the cultivator. After the plants have finished flowering, the old stems die to the ground in most cases, and from beneath the surface produce a number of "sucker" shoots, each with a separate root system. To make large plants three of these suckers may be planted in a triangle about six or eight inches apart, or, if the soil is rich, one will suffice. The plants may be set out early in September, and allowed to grow steadily. When about a foot in height, they should be cut back to within six inches of the ground, when they will break into side growths, which will form dwarf, sturdy plants. They should be supported, and the tops again removed when about eighteen inches high, after which they should be allowed to grow uninterruptedly. Unless the blooms are to be thinned, no other treatment is needed, except the usual cultivation, watering, and supporting that is practised in any well-managed garden.

Cultivation for Exhibition.

Most of the chrysanthemums grown for exhibition by amateurs are cultivated in beds, or as such cultivation is usually described, in the open

ground. This is to distinguish such culture from that where the plants are exclusively grown in pots. In pot culture it is an important point to propagate the young plants from cuttings. from which the "eyes" that are below the surface are often removed. In the open ground it is not of much importance, as the suckers that often occur are easily removed without damage to the roots of the plant.

In pot culture it is necessary to "feed" the plants with liquid manures early in the season, the plant food in the small quantity of soil being soon exhausted. In a well-prepared bed such feeding is altogether unnecessary until a much later stage is reached. Most of the fine exhibition

JAPANESE VARIETY, "LADY NORTHCOTE," WHITE INCURVED TYPE.

varieties can be grown to produce as good flowers in the open ground as in pots. It is necessary to provide a covering of canvas or calico when the flowers are opening, to protect them from dews, sun, rain, and wind, the latter especially. Narrow beds that contain two rows of plants are most easily managed. A bed 20 feet long and 6 feet wide will accommodate 24 plants; a light framework can be erected and covered with calico easily and cheaply. The writer's plants are grown in such beds, and are treated in the following manner:—Suckers are taken from the old plants after the flowering season is over, and rowed out in rather poor soil until October. The beds are each season prepared in ground that was occupied by other plants the previous year. A liberal dressing of half-

rotted stable manure and bonedust is deeply worked into the beds in the winter, and the beds are allowed to remain till the planting season in a rough, loose condition. The soil is light sandy loam, and the whole bed is again dug and firmly trodden. The plants are rowed out 18 inches from the edge of the beds in each direction, 3 feet being allowed between each row, 18 inches between each plant. The beds face east and west, so that the plants, when covered in autumn, are protected from the north and south winds.

JAPANESE VARIETY, "F. S. VALLIS," YELLOW, LONG DROOPING FLORETS.

At planting time any suckers or prominent "eyes" are removed from the young plants, and the after cultivation is hoeing the surface of the beds, tying the growing shoots (of which three are selected to form the plant after the first break into side growth) as growth advances, and removing all lateral and sucker growths that occur. In very hot, dry weather, a thorough watering is applied, but only when the plants need it. During February, a flower-bud usually forms in the point of each shoot. This is what is known as the "crown" bud, and produces the best bloom. All growths around it are carefully removed, and the flower-bud allowed to develop.

The buds are liable to be attacked by caterpillars of various moths at this stage, so a careful and frequent examination is necessary. When the buds are about the size of a filbert, liquid manure made from horse-droppings and soot is applied, as also occasionally liquid guano manure. If any variety is extra vigorous, with large glossy foliage, it receives no liquid stimulant. When the flowers begin to expand, they are protected by unbleached calico blinds, so arranged that they can be rolled up if necessary. Fine blooms are usually produced.

A list of Japanese varieties of fairly easy culture and varying form is as follows:—"Lady Northcote," "Madame Carnot," "Miss Maud Jeffries," "Miss Nellie Pockett," "The Princess," "Mrs. F. F. Thompson," white; "F. S. Vallis," "Lady Talbot," "Duchess of Sutherland," "Charlie Cronin," "Cheltonii," "Mrs. William Knox," "Mrs. W. Mease," yellow; "Lady Hopetoun," "Mrs. F. S. Grimwade," "Beatrice May," "Miss Anetta Henley," "Miss A. Kellerman," pink; "Lord Hopetoun," "W. R. Church," "T. Carrington," "Rosy Morn," "J. H. Doyle," "E. J. Brooks," "Mrs. James Marshall," crimson, and purple shades.

Flower Garden.

Those who contemplate planting deciduous trees and shrubs, roses, &c., should lose no time in making the necessary preparation. With the fall of the leaf is the best time for planting, the subject then more nearly approaching a dormant condition than at any other period. In preparing land for the reception of trees or plants that may be expected to grow for many years where planted, provision should be made for a lasting supply of food and moisture. Working and enriching the soil to a depth of 2 feet will enable most plants, when established, to endure extremes of heat and drought, if ordinary cultivation of the surface is practised.

Good drainage is an absolute necessity. If it is not possible to lay drains that would effectually draw off all surplus moisture from the beds, it is far better to raise the surface of the beds than work deeply. No drain is of much use that is not placed in a clay or subsoil of a more retentive nature than the cultivated soil. Where undrained paths cross the natural fall for the water, the beds in wet weather are often mere dams. The water, finding the path barrier harder to penetrate than the worked soil, follows the line of least resistance, and often practically fills the whole area, souring the soil. Drains (below the level of the worked soil) should be laid at intervals through such paths. Planting should not be done when the soil is very wet, nor should hot, crude manures be brought into contact with the roots.

A number of new roses have been imported by various nurserymen, and plants of many varieties are available. Several of the novelties are very promising, but two kinds that were specially inquired for on account of the descriptions, coloured plates, and reports from England, have not yet flowered here. Those are "J. B. Clark," a gold-medal rose; H. T., described as a deep scarlet, shaded blackish crimson; and Charles J. Grahame, H. T., orange crimson. In growth, "J. B. Clark" approaches very closely to the Hybrid perpetual section. Good flowers were seen during autumn of "Betty," "Hon. Ida Bingham," "Mrs. John Bateman," "Jakobs Perle," "Graff Fritz Hochberg," and "Grand Duchess Alexandra," a beautiful white variety.

Sweet peas are becoming more popular each year, owing to the improved varieties that are being raised. They make fine border plants when properly grown and trained, and are very useful for decoration. The seed should be sown at intervals from June till August, to have them in flower until the hot weather comes. The most common cause of failure is sowing the seeds too thickly. Six or eight inches should be allowed between each plant.

Kitchen Garden.

Ground should be prepared for onions, peas, broad beans, and other vegetables that will be required in season. In soils deficient in lime, where it is proposed to grow peas and other leguminous crops, a good dressing of fresh lime is most beneficial. It should not be used with stable manure, as it drives off ammonia, one of the most valuable constituents of such manures.

Onions ready to transplant may be set out now. The practice of cutting off the tops and part of the roots of the young plants, when preparing them for transplanting, is general in the market gardens near Melbourne. The plants are easily handled, and suffer nothing by losing the first-made roots, which are always practically destroyed in the transplanting process. It is also claimed that it minimizes the risk of transferring root eel-worms to various parts of the garden, should the plants in the seed-beds be affected. Only the roots should be inserted when planting, a most common cause of onions failing to "bulb" being deep planting.

Seeds may be sown of peas, broad beans, onion, and cabbage, to insure a succession. Weeds should be removed from young growing crops; and corners that harbor snails, woodlice, &c., should be cleaned up and dressed with hot lime or salt.

POULTRY FOR THE CLOSER SETTLEMENT SETTLER.

H. V. Hawkins, Poultry Expert and Lecturer.

With the advent of settlement of our young men in large numbers on the land, I am convinced that poultry will play an important part with the small farmer. The egg in the kitchen cannot be dispensed with; it is as salt is to the food we eat. In addition, greater facilities should be given the small farmer in securing reduced rates on our railways, and, with a united effort to co-operate, markets may yet be found which will bring about a revolution with hen products. Then, instead of the middleman reaping the profits, the settler will devote more time to the golden hen.

Value of Co-operation.

Suppose, for example, the Wyuna settlers make up their minds to breed poultry, which I have no doubt they intend doing, I would strongly urge them to meet together and discuss with the writer matters of such importance as co-operating in the purchase of material at wholsesale rates. By the combined efforts of many, wire mesh can be had at reduced prices, and instead of paying so much freight and cost of cartage on a few rolls, they could receive a truck at half the freight. In the selection and purchase

of stock co-operation can again be resorted to, with great saving to each individual, by securing the services of an authority on poultry, he being more competent to select sound, healthy stud birds. By ordering a large number they could be obtained at reduced rates. Then, again, foodstuffs that cannot be grown on the settlement could be bought in large quantities at wholesale rates. Thus, even in commencing to farm poultry, £5 per man at least could be saved, which is an item to each settler. In the same way could the carriage of timber, iron, wire, nails, &c., ruberoid, shelter trees, live stock, foods, incubators, and brooder houses be managed. They should appoint one of their number to act as the settlers' agent, he to be responsible for the whole, the proper distribution of goods, and the collection of all monies; and, further, he could receive each settler's eggs daily, or, say, twice weekly. The eggs should be graded according to size and colour, must be clean, and should be well packed, and sent direct in large parcels to either the cool stores (to wait the rise of market) or to the firm with whom the settlers may contract to supply eggs. Thus, instead of each individual settler sending his few eggs to Melbourne, this one agent would be the collecting centre and the one distributor. Think of the amount of time saved, and the additional profit which would accrue to each individual settler.

My advice to the Wyuna settlers, therefore, is, whenever they require goods or wish to dispose of produce, that they should combine together. Further, to earn a name for their hen products, they should make a big effort to keep a uniform type of fowl—make the settlement known for its quality of poultry. A good reputation is worth much. For example, instead of Jones breeding modern (leggy) game, which do not pay, and Smith breeding Langshans (also leggy), and Brown having breeds such as Cochins or Brahmas (which cost almost as much to feed as does a cow), follow the example of one who has made this question a lifelong study, and who knows what the consumers abroad require.

WHAT TO BREED FOR LOCAL AND HOME MARKETS.

Select an Indian Game Cockerel, with six Buff Orpington second-season hens. These make an excellent cross, can be obtained in any numbers, and are admirably adapted to the climatic conditions of Wyuna, being very hardy. This selection would simplify matters considerably. If all agreed to send nothing to market but this one grand cross--which, when hatched at the right time, would in five months average 6 lbs. weight, having fine big bodies, and, being low set, long keeled, and white legged, and with the flesh white and succulent—what a sight they would be! Being of uniform type and colour, and symmetrical in appearance, they would command top prices, either for local consumption or for export. The settlement would soon receive a great name for poultry, just as the firm of "Lea and Perrin" has for its renowned sauce.

Then, as to egg production, the settler naturally asks, "Will this cross produce abundance of eggs?" My answer is, "Only a fair number"; and I would recommend keeping a breed for eggs only. That breed should be the pure White Leghorn, which will thrive at Wyuna; they are great foragers, are the best breed to keep for egg production, and are always obtainable at a reasonable figure.

This, then, should suffice for all practical purposes, *i.e.*, eggs and flesh. "What to do and how to do it" will be my subject to the settlers at

Wyuna when opportunity offers. Whatever is the decision arrived at regarding this subject on which much will depend for early returns—co-operate, co-operate! Union is strength, and to this end let the settlers of Wyuna and other estates strive. Success is assured, as far as poultry products are concerned.

The Despatch of Poultry.

Of all farm animals, none are so shamefully treated by the farmer as are fowls and ducks in transit to the consignee. Visiting so many centres throughout the State, I am able to judge of their comfort or otherwise. Last month, when travelling from Warracknabeal, I observed a number of birds on the Murtoa station, packed like sardines, with scarcely breathing room. It is time breeders were compelled by law to provide proper accommodation for their stock while in transit. This is the class of so-called poultry farmer who retires from the business in fairly quick time, and it is as well.

Of what use is my lecturing and demonstrating to the farmer how to produce the fowl for home markets if these rules are disregarded? Have I not often repeated that fowls require a thoughtful and intelligent owner? Without thought and intelligence failure is certain. A regulation is necessary for the guidance of railway officials, giving them power to refuse to despatch any live stock unless in proper sized crates or boxes, and not more than a given number in each one. Is it any wonder that the agent deducts off the farmer's returns for loss of weight or for deaths? It frequently happens that fowls and ducks lose ½ lb. to 1 lb. weight by insufficient air, &c., during a journey of thirty hours. Does the consignor not realize that it takes two to make a deal? Be fair to the stock, and also honorable to the consignee. Last week, at Castlemaine, I saw six ducks crushed together in a gin-case.

Sale Rooms—The Need of Inspection.

Another point of great importance is the unsatisfactory condition of some auction rooms, where sales of poultry are conducted. I refer to the filthy pens, which are fixtures, and receive scant attention, in so far as that important essential to public health is concerned—cleanliness. It is highly desirable that officers should be empowered to deal with offenders in this regard, not only to compel observance of the rule of cleanliness in the sale rooms, but also on the farm.

Coops, instead of fixtures, should be used in the auction rooms. They should be moveable, and have floors made to draw out, to allow of disinfecting and thoroughly cleaning after each sale day. Almost every known disease has at one time or other been left in wooden pens by germs. It is a menace to the public health, and often creates a feeling of dislike and disgust for this usually much-enjoyed delicacy. We breeders desire to increase the consumption of the hens' products. Knowing full well that by lowering the quality of any food product we decrease the demand for that product, it is therefore to the breeders, agents, and consumers' interests that the birds should be kept under the most favorable conditions. The result will be better kept yards and more of them, a greater demand for the table bird, and larger profits to all concerned. These results can be achieved at a small cost—cleanliness—without which no poultry breeder has declared a dividend, and never will.

SOME ERRORS NOTICEABLE IN THE MANAGEMENT OF BUTTER FACTORIES.*

R. T. Archer, Dairy Supervisor.

This subject has been chosen particularly for the benefit of the younger and less experienced members of the Association, not that there is anything new to disclose, but there are some points in management wherein, from want of thought generally, apparently slight errors cause considerable trouble and worry, and I scarcely need say that enough of these fall to the lot of a butter factory manager without increasing them needlessly.

Everyone connected with the industry will admit that the average supplier is difficult to reason with, and to make understand the meaning of the two golden rules in connexion with the management of dairy produce, that is, the necessity for cleanliness and coolness in the handling of the raw product until it is delivered at the factory. It is an old proverb that "Example is better than precept," and if we want to make suppliers observe the strict cleanliness so necessary for the production of a first quality butter or cheese, we must set the example by keeping everything scrupulously clean and tidy at the factory, and the moral effect will be considerable. We have to gain the confidence of the suppliers, and this is no easy matter at times when our competitors are strenuously working in exactly an opposite direction, and this alone should make us additionally careful that all our operations should be correct and above suspicion. We may consider here what are the points most calculated to produce want of confidence in the supplier, and I think by far the most important is the return for the cream supplied. Some suppliers try numerous dodges which they consider clever to catch the manager napping. To combat these, we must be sure that we are working on correct lines, when we will have nothing to fear from any tricks played upon us. We must be absolutely sure that we are giving the supplier correct returns for the cream supplied, and this we can be if the sample is properly taken and tested.

In the majority of instances, cream delivered to the factory is too thick to admit of being thoroughly mixed by stirring. In such cases, the only way to get a correct sample is by means of a glass or metal tube, with an air-tight plunger working like a syringe. The rod of the plunger is held stationary at the level of the top of the cream, and the tube pushed steadily to the bottom of the can. A vacuum is created in the tube, which is filled by the cream. In this way a complete core of the contents of the can is taken from top to bottom, giving a correct sample; be it cream or water, you get an aliquot part of each, which when properly tested, will give you a correct estimate of the amount of fat contained in the can. Mr. Carroll will deal with the question of testing, so I need not go into that. but a word about the sample after it is taken. If this is put into an open jar it must be tested within a few hours. If it is not convenient to test every day, the sample must be put into a bottle, a few drops of formalin added, and securely corked. If the samples are kept in an open jar for days together, especially in hot

* Paper read at the Thirteenth Annual Conference of the Australasian Butter Factories' Managers' Association, held May, 1906, at Melbourne.

summer weather, a large amount of moisture evaporates, in which case a false estimate of the original fat-contents is obtained.

I have conducted some experiments with the object of discovering to what extent the tests are influenced under these conditions, and found that cream testing 40 per cent. fat when freshly sampled, four days later tested 40 per cent. if kept in a stoppered bottle, and 50 per cent. if kept in an open jar, and in the case of cream with a low fat-contents the difference was much greater owing to a more rapid evaporation of water. This sometimes accounts for the low percentage of over-run that some factories show. The worst feature of this, however, is the fact that suppliers soon find that the more skim milk they leave in their cream, or, in other words, the thinner they separate, the better the returns they receive from the factory, and this further works against the factory, because the lower the test, the more rapidly the cream ripens, and subsequently goes off, the milk coagulates in the cream, and in churning becomes incorporated in the butter, which prevents it from keeping. Also, it is the low test cream that churns in the cans during transit, particularly in the warm weather. We should have a minimum test allowable in cream from the home separator, and this should certainly not be below 40 per cent. of fat. I think most of you will agree with me that the most satisfactory cream is that testing between 45 per cent. and 55 per cent.

Perhaps the worst feature of the home separator system, and I think the one that has worked the most mischief with regard to the average quality of the product from that source, is what may be termed the illicit competition between factories in which the suppliers are absolutely misled as to the quality of the material they are delivering to the factory. Very few farmers are competent to judge the quality of cream or butter, and they have to, or should, be guided by what the factory manager tells them, but if a farmer takes his cream to a factory, and the manager tells him it is second quality, then he takes the same cream away to another factory, and is told that it is "A1, couldn't be improved," which is the farmer to believe? Naturally he is only too pleased to believe the latter, and he goes home satisfied that his system of caring for the cream is correct, and no improvement is effected. On the contrary, he is inclined to be more careless, and particularly is this so when he is paid the same price--I do not say the same amount of money—as those who are taking every possible care, and deliver their cream in good condition. The tendency is for the careful dairyman to become careless when there is no evidence that he reaps any advantage over his careless neighbour. The factory managers who work on those lines—and I know there are some—are making a rod for their own backs, and are a menace to the industry. All those who have the welfare of the industry at heart should work strenuously together to put down this evil.

I cannot pass this question without mentioning what I think will be the salvation of the industry now that the home separator system is spreading to the extent that it is. I refer to the pasteurization of the private separator cream. You may know that this is carried out very extensively by the Colac Company, and with eminently satisfactory results. In fact, cream treated in this way produces practically the same quality of butter as the cream separated from milk delivered to the factories and creameries. It is found that cream two days old can be pasteurized, provided it has been properly cared for, and this in itself

increases the value of it by about ½d. per lb., for by the aid of a pure culture of lactic acid bacillus a choice flavoured, good keeping butter is produced.

CREAM TESTING BY WEIGHT VERSUS MEASUREMENT.*

P. J. Carroll, Dairy Supervisor.

The subject of testing cream by weight has been much in evidence of late. Many factories have already adopted the system, and it is to be hoped that before long all factory managers and boards of directors will see the wisdom of paying for their cream on the results obtained by this method.

It is not my intention to weary you with a number of technical reasons in support of the weight method as against measurement, but merely to bring the matter before the conference, so that those of you (if any) who are not thoroughly conversant with the matter may gather some useful information by the discussion which I trust will follow this paper. You are all aware that at the time of the introduction and general adoption of the Babcock test in Victoria as a means of determining the relative value of different suppliers' milk, very little private cream was dealt with. Since the advent and spread of the home separator, however, some method by which the cream could be tested in the same manner as milk was sought for, with the result that the Babcock test was again employed, the operation varying only to this extent: that instead of testing 17.5 c.c., as was the case with milk, 8.75, or half the quantity was used. The flasks, of course, were of a different sort, being made broader in the neck, so as to accommodate the higher percentages of fat, and graduated accordingly.

It was soon discovered, both here and in other dairying countries of the world, that this method of measuring the samples could not be relied upon, chiefly on account of the wide variation in the fat percentages of the cream delivered, the inclusion of air, and the presence of gas produced by fermentation, all of which cause a wide difference in the weight of a given volume of cream. To these points I will endeavour to direct your attention, and set out as clearly as I can the main reasons why the weighing of samples of cream is the only correct method at present practicable for the estimation of the butter-fat in cream.

It is already understood that, in order to correctly grade the milk flask now in use, some specific weight of material had to be acted upon; 18 grammes was the quantity selected, and this quantity it was found could be delivered by a pipette graduated to hold 17.6 c.c. The scale on the neck of the bottle is marked from 0 to 10 per cent., thus showing that the graduated portion is exactly 1.8 grammes, or 10 per cent. of the 18 grammes. As the specific gravity of butter-fat at about 140 degrees (the correct temperature for reading) is .9, the space occupied by the scale would be 2 c.c.'s. Now, this same rule applies in the case of cream bottles graded up to 30 per cent., only that the space occupied would

* A paper read at the Thirteenth Annual Conference of the Australasian Butter Factories' Managers' Association, held May, 1906, at Melbourne.

be 6 c.c.'s instead of 2, it being necessary, as I said before, to provide for the higher percentage of fat contained in cream as against milk.

The preceding paragraph was written with the object of placing the system of testing by measurement as clearly as possible before you, so that I may be able to show the error introduced by the adoption of measurement instead of weight. It was found that, as 17.6 c.c. of cream could not be tested without a special outfit, owing to the higher percentage of fat requiring a scale out of all proportion to the size of the present flasks, and to the probability of having to procure a special centrifuge to hold these bottles. It was therefore decided to adopt half the measure of cream, 8.75 c.c., and rinse the pipette with warm water to remove the cream adhering, and to double the result when the test was made to give the true percentage, hence the reason, I believe, for the use of the 8.75 c.c. pipette for cream testing.

To illustrate the different specific gravity of cream of varying fat percentages, I have prepared the following table, setting out the different features, and showing the approximate loss when samples are measured instead of weighed: -

Specific Gravity 62 F	Per Cent Fat in Cream.	Weight Delivered by 17·6 pipette.	Readings by Measurement.	Readings too Low.	Errors in 100 lbs. Fat.
				Per Cent	
1·008	20	17·3	19·3	·7	3·5
1·002	25	17·2	23·8	1·2	4·8
996	30	17·0	28·4	1 6	5·3
·980	35	16·4	32·0	3·1	9·1
·966	40	16 3	36·2	3·8	9·5
·950	45	16·2	40·5	4·5	10·
·947	50	15.8	44·	6·	12·

In order to reduce the foregoing to practical working, we will assume that two suppliers, Jones and Thompson, were delivering cream to the factory. Jones' cream tested 30 per cent. by measurement, and Thompson's 50 per cent. Jones delivered 560 lbs. of cream testing 30 per cent., and was paid for 168 lbs. fat; Thompson delivered 336 lbs. cream, testing 50 per cent., and was paid for 168 lbs. fat. If both samples of cream were weighed, the result in fat would be -Jones' test, 31.6 per cent., equals 177 lbs. fat; Thompson's test, 56 per cent., equals 188 lbs. fat; or an increase in Jones' case of 9 lbs. of fat, representing over 5 per cent., and in the case of Thompson 20 lbs. fat, representing 12 per cent. increase on the total fat.

COMPARISON.

	Lbs Cream	Test by Measure.	Lbs. Fat.	Test by Weight.	Lbs. Fat.
Jones	560	30	168	31·6	177
Thompson	336	50	168	56	188

The error in Jones' case amounts to 9 lbs. fat, representing 5.3 per cent.; and in Thompson's case 20 lbs. fat, representing 12 per cent.

It will be seen from the above that if Jones' and Thompson's fat is calculated on the measurement basis, it would pay Thompson handsomely to reduce his cream to the same fat percentage as Jones', for in every 100 lbs. fat delivered he would make a gain of close on 7 per cent. On the other hand, when commercial butter is paid for, and the surplus divided equally on the fat basis, Thompson would be penalized to the extent of 6 lbs., and Jones would benefit to the extent of 6 lbs. at Thompson's expense—that is, Jones should have been paid for only 204 lbs. commercial butter instead of 210, and Thompson should have been credited with 216 lbs. commercial butter, instead of only 210 lbs.

	MEASUREMENT.			WEIGHT.		
	Lbs. Fat by Measure.	Per Cent. Overrun.	Lbs. Com. Butter.	Lbs. Fat.	Per Cent. Overrun.	Lbs. Com. Butter.
Jones	168 plus	25	210	177	15	204
Thompson ...	168	25	210	188	15	216
			420			420

Jones gains 6 lbs. commercial butter on the transaction, and Thompson loses 6 lbs. in the same calculation, owing to the error introduced in the measuring of samples for testing instead of weighing.

So much for the difference in fat percentages and inclusion of air in cream. There is yet another reason to account for, and that is the gas produced through fermentation. As you are all aware, gas will not weigh when placed on the scales, but will cause displacement in a volume, and render the act of measuring under such conditions unreliable. The table of specific gravity and weights delivered by a 17.6 pipette of such creams, whilst not the result of local experiments, is based on numerous tests conducted by Professor Farrington, of the Wisconsin Dairy School. These are borne out fairly well by several sets of experiments carried out by myself and other officers of the Department, one of which is shown in the following table of readings:—

No.	Weight.	Weight.	Measure.	Readings too low by Measure.	Actual Per Cent. in 100 lbs. fat.
1	16	...	15·5	·5	3
2	19	19	18	1	5¼
3	19	..	18	1	5¼
4	19·5	19·5	18·5	1	5
5	20·5	21	19·5	1·25	6
6	21	.	19	2	9½
7	21	21	19	2	9½
8	21·5	21	20	1·4	6½
9	22	22	20	2	9
10	22	22	19·5	2·5	11½
11	26·5	26	23·5	3·25	12
12	26·5	...	23	3·50	13¼

It can plainly be seen that, both in theory and practice, measuring cream for calculating its butter-fat results is absolutely wrong, and it requires no further words of mine to convince you of the importance of at once discarding a method which is so palpably unfair and inequitable. I will, however, read another table in order to illustrate the effect when several suppliers' creams, ranging from 20 to 50 per cent. fat, are being treated; each delivered the same quantity of fat, but a different return is given owing, of course, to the error introduced by measurement.

No.	Weight of Cream.	Per Cent. of fat in 18 grs.	Per Cent. given by 17·6 c c. pipette.	Error in Reading.	Actual fat Content of Cream.	Total fat paid for.
	lbs.					
1	500	20	19·3	·7	100	96·5
2	400	25	23·1	1·2	100	95·2
3	334	30	28·4	1·6	100	94·8
4	286½	35	32	3	100	91·6
5	250	40	36·2	3·8	100	90·5
6	222½	45	40·5	4·5	100	90·1
7	200	50	44	6	100	88

NEW ZEALAND FLAX.

(*Phormium Tenax.*)

Joseph Knight.

This useful and most profitable plant has been brought most prominently before the Victorian public recently by a Mr. Tait, who has an invention which is said to be a new method of extracting the fibre. As an effort has been made to float a company to work the same, considerable inquiries have been made for particulars as to what the plant consists of.

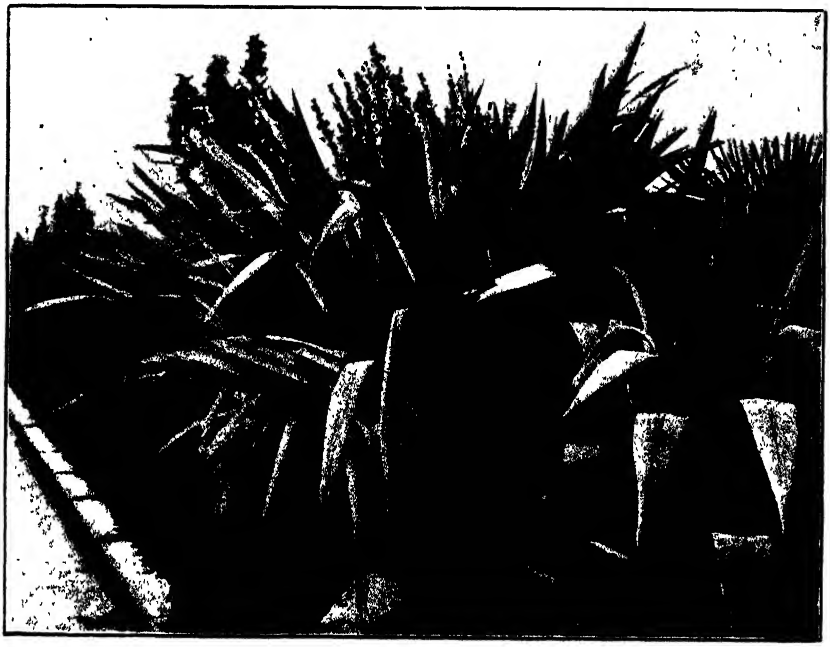
It is somewhat surprising the confusion that exists in the minds of many as to what constitutes New Zealand flax. and flax produced from the plant *Linum usitatissimum*. These plants differ so widely that I think it is advisable to reproduce illustrations of each, so that they may be identified. As the *Linum*, which was dealt with in the last issue of the *Journal*, is now favorably and well known in the State, and need not be further referred to, the only object in writing this brief treatise is to place a few facts before those who may be interested in *Phormium tenax*. The plant is well known in Victoria, and may be seen growing in most of our gardens. It is the principal plant employed for filling up all new plantations along streets, as it is hardy, and thrives well under most conditions.

The Agave varieties, which produce the well-known Aloe fibre, are also confused with the *Phormium tenax*. A specimen plant is shown in the accompanying illustration. It will be readily recognised, as many varieties may be seen growing in yards and elsewhere.

NATURE OF THE PLANT.

Sir James Hector, in his valuable publication on *Phormium tenax*, which has passed through several editions, gives the following description. I am also indebted to this publication for the illustration of the sections of the root-stalk and other information:—

"*Phormium tenax*, belonging to the Silaceous family of plants, was first mentioned as occurring in New Zealand by Captain Cook, who says: 'The country produced a grass plant, like flags, of the nature of hemp or flax, but inferior in quality to either. Of this the natives make clothing, lines, nets, &c.' Royle states that 'the leaves of the plant are perennial,



PLANTS OF PHORMIUM TENAX AND AGAVE.

(The Agave is on the right side of the illustration.)

hard, sword-shaped, and from 5 to 7 feet in length, with a flower-stalk rising 4 feet or 5 feet above them, and bearing a profusion of flowers, followed by triangular seed vessels, filled with flat and thin black shining seeds. It was introduced in the year 1798 into the South of Ireland, and has been found to flourish on the west coast of Scotland, though European winters are occasionally too severe for it.'

This general description applies to the Phormium plant wherever it grows in New Zealand and Norfolk Islands, to which countries its natural range is confined; but it presents many minor variations in habit of growth, according to the climate and soil. These differences are not, however, so great as might be expected to occur in a succulent plant that ranges through 18 degrees of latitude, or from almost a tropical, insular climate to a country possessing a severe winter climate, with prolonged frosts and snowstorms."

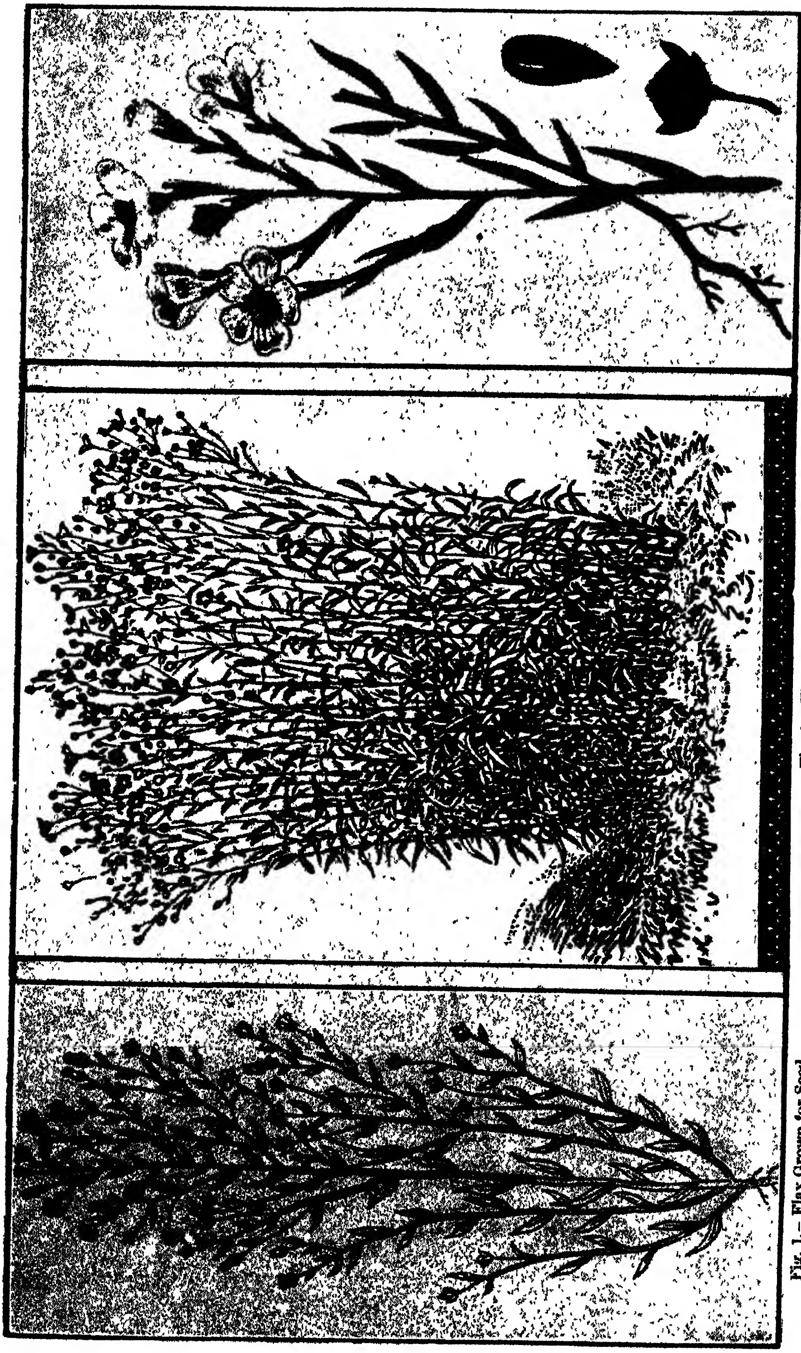


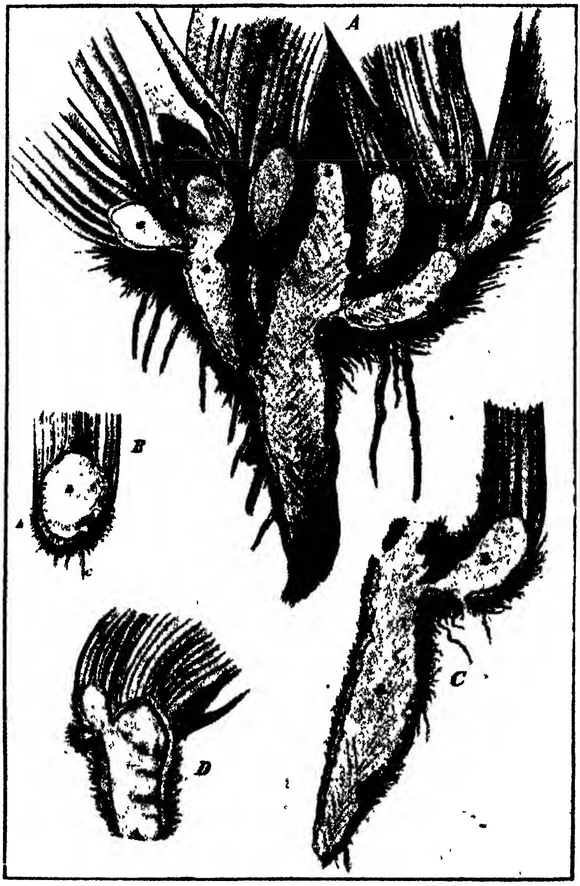
Fig. 3.—Flax Plant.

Fig. 2.—Flax for Fibre.

FLAX PLANT (LINUM USITATISSIMUM).

Fig. 1.—Flax Grown for Seed.

The accompanying plate shows the sections of the root-stalk of the Phormium, illustrating the mode of growth and propagation:—A. Section or compound rhizome, or prostrate stem, of *Phormium tenax*, showing (*a*) main axis, or central stem, from which a flower-stalk (the terminal axis of the plant) has been given off at *b*, *c*; lateral shoots forming new leaf-buds; and, ultimately, fans that accumulate nourishment at the base of their leaves, throw out rootlets, and finally become independent of the



STRUCTURE OF ROOT OF PHORMIUM TENAX.

parent leaf, as at *d*; (*e*) first stage of buds from which lateral roots spring. B. Section of root of *Phormium tenax* in best condition for transplanting, showing—(*a*) Mass of fibrous, starchy, and resinous matter accumulated for the nourishment of the future flower-stalk and lateral buds; (*b*) cortex layer, formed from the bases of the old leaves; (*c*) rootlets. C. Underground stem of manunu (one of the best varieties of *Phormium tenax*), showing—(*a*) Main axis that has flowered and completed its life; (*b*) lateral shoot by which the life of the plant is continued.

CLASS OF SOIL SUITABLE.

It would be difficult to say what soil this hardy plant will not thrive in, but there are certain conditions which it must have to be successful. There is one in particular—that is sufficient moisture. It does not mean, as is generally supposed, that it wants a swamp, or a running stream, but a humid climate, so as to assure a constant and steady growth. In the dry, arid districts it will be found thriving well along the water channels, and where the soil is free it makes wonderful growth.

Much depends on the variety planted. The late Baron von Mueller describes both hill and swamp varieties. Sir James Hector mentions, in the publication previously referred to, 50 varieties which are recognised by the natives, but it is questionable whether many of these are not the same, or at least "sports" or hybrids, as must be the case when plants are grown together, and springing up from seed dropped. There is also in the work referred to an account of 25 acres being planted by the "Patea Flax Company," in which the number of varieties selected consisted of six, described as follows:—

Oue ...	...	Red edge
Atiraukawa	...	Light; bronze edge
Korako	...	Black edge, light colour in leaf
Huhiroa	...	Black; narrow edge
Atewheke	...	Scarlet edge
Tihore	...	Orange edge and keel.

Unfortunately, whilst giving the names of varieties, they do not describe the class of land planted. To plant the hill varieties in low-lying land, or swamp varieties on the hills, would be a mistake.

Varieties should be selected to suit the soil and other conditions. My experience leads me to say that on the light-red chocolate soil in our highlands, where the rainfall is good, any of the hill varieties will make a growth fully equal to any described.

The same applies to light sandy or loamy soil where there is sufficient moisture, with drainage. The so-called swamp varieties will do well in a situation such as the banks of a running stream, or where the land is occasionally flooded, but will not thrive in low, stagnant pools. The best growth is made in reclaimed swamps, or where the swamp has been partly drained to the depth of 1 foot or so.

It cannot be too strongly impressed on the minds of those about to plant that the soil and the variety must be considered. There should be no difficulty in getting soil to suit the class of plants available. There are large tracts of country along the coast, portion of it covered with cut grass, and useless for any purpose. Much of this land, with proper treatment, would produce flax in abundance. This was recommended by the late Baron von Mueller over 40 years ago, when distributing plants, &c., from the Botanical Gardens.

Phormium tenax is one of the most hardy plants introduced, and there is no difficulty in finding suitable soil in most parts of the State.

PROPAGATION.

There are two methods by which plants may be provided, namely, "seedlings" and "division of roots." The division of roots, or stools, is that generally recognised as being the best.

The illustration on page 354, copied from Sir James Hector's work, shows the root system of the plant, and sets forth at a glance how the divisions are to be made. A well-grown plant will give from 50 to 100 sets, and by careful selection the best quality of plants could be secured. This is most important to those about to plant in this State, as it is generally recognised in New Zealand that only a portion of the plants growing are of sufficient value, from a fibre-producing point of view, for the labour incurred in its extraction.

When planting from one set, as described above, none but such plants as are approved of should be set out. The testing of a leaf or so of each plant is extremely simple, and need not be referred to here; but if this precaution is taken, as I have already stated, nothing but suitable plants will be selected.

BED OF SEEDLINGS TWO YEARS OLD.

The second system is raising plants by seed. This takes a much longer time in bringing plants to maturity. Whilst it may be considered a reasonable thing to expect a cutting in a plantation when from three to four years old, it would take much longer with seedling plants.

The above illustration shows a bed of seedlings two years old, grown by the officer in charge of the gardens of the City Corporation, on the banks of the Yarra. His method of raising is simple, but effective. The seeds are sown in boxes; when they reach a certain stage they are potted out, and after remaining some time they are set out in beds, as shown in the illustration. As these plants are raised for ornamental purposes only, the methods adopted by him will not answer so far as selection is concerned.

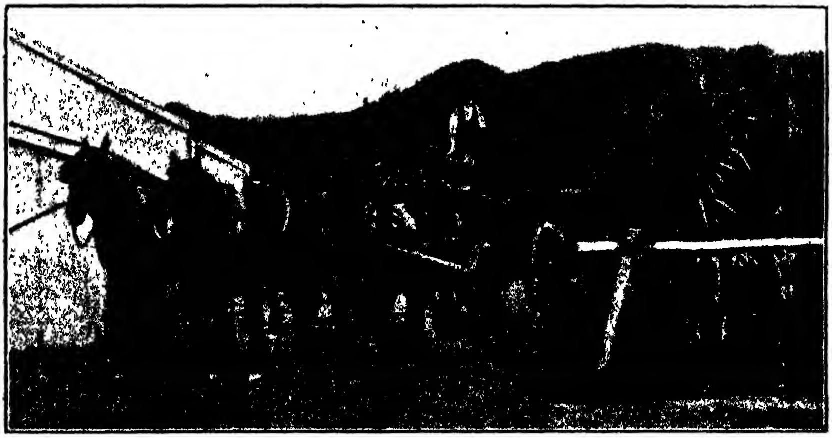
It is well understood that when a number of plants of the same variety are grown together that the flowers become hybridized, and that the seedling cannot be regarded as characteristic of the parent. No doubt, it is a

much less expensive way to secure plants; but where, as in this case, a plantation is made for almost all time, it will repay the selection of plants when planting.

To those who have isolated plants growing, and these of sufficient merit to warrant their use, the seeds may be used with safety; but where there is any chance of the plants becoming as described above, it would be unwise to adopt this course. I regret to say that in New Zealand, where this industry flourishes to such a large extent, very little attention is given to the selection of plants; although it takes a certain number of tons to produce a ton of fibre, it is recognised that by selection and cultivation the same weight of leaves will yield twice the amount of fibre. I cannot help thinking that in the establishment of an industry of this kind it is imperative that a thorough investigation should be made into the character and condition of the plants about to be set out.

METHOD OF PLANTING.

There is nothing to guide us in this respect so far as plantations are concerned. The crops of *Phormium tenax* are generally self-sown, and in



ARRIVAL OF GREEN LEAF.

their natural state grow without cultivation, but the principle is similar to various other plantations which have to be worked by manual labour. The character of the soil will have much to do with distance and other arrangement. The plants, when full grown, spread out, covering from 4 to 6 feet in width, and whilst they would be kept in check to a certain extent by an annual cutting, the planting would necessitate allowing sufficient room for the plants to develop thoroughly.

The plantation of the Patea Flax Company, referred to previously, was set out in rows 6 feet apart, and plants standing 6 feet between each other in the rows; but it is quite clear that where the land is suitable, and other conditions favorable, that the ground would be completely covered, and the plants become stunted from want of nourishment. If an additional two or three feet were left between the rows, it would allow for the working generally of the plantation.

It must be borne in mind that there is a great bulk of material to be taken from a plantation. The yield is said to be from 12 to 18 tons per

acre, and to get this away it would be necessary to have roadways, as in vineyards, say, every ten rows, to gather up the bundles of leaves.

The previous illustration is taken from a New Zealand report on flax. It shows the haulage on the wheels. It will be easily seen that it would also be advisable to leave plenty of room for the vehicles to pass, or in many cases the plants would be damaged. The practice in New Zealand amongst the natives is to plant two or three sets in a hole. By this means, no doubt, an earlier return is secured, but it is questionable if the practice is advisable. When plants are somewhat difficult to get, it would be preferable to put in single plants, as their growth is rapid under favorable conditions, and in a short time the ground would be fully occupied. The set or sets are placed in a shallow hole, and the fibrous roots spread out when the earth is well tramped down. The depth of planting should not be more than three to four inches below the surface. The outside leaves should be cut back, but not the inner ones. This will enable the plant to become firmly established, when it will make a vigorous and healthy growth.

The advantages of a little care in planting, where both lines are kept, would considerably facilitate the after working. Phormium plants readily respond to thorough cultivation, especially in the earlier stages of their growth. In the case of planting trees, vines, &c., it is a great advantage to be able to cross-cultivate, and thereby keep the land in proper tilth. The wisdom of this has been generally recognised by orchardists and vignerons.

TIME OF PLANTING.

The most suitable season for planting is autumn, but when that is not convenient early spring may be adopted. With autumn planting, the sets become established by the heat retained in the soil, and will pass the winter over without suffering. Such plants may be also said to save a season's growth, as they are able to take advantage of the full spring season. But spring growth will answer equally well so far as the establishment of the plant is concerned.

The plant is an extremely hardy one, and will adapt itself to conditions where other plants would perish. In the establishment of an undertaking like this, it is advisable, where practicable, to have the soil thoroughly in order, and to plant out in early autumn.

GATHERING THE LEAF.

The plant consists of a number of shoots clustered together, each shoot producing a quantity of leaves, which strike up from the centre. The outside leaves, when not gathered, wither and die, and are of little value for fibre; but, when gathered annually, they are cut off near the bottom, leaving two or three centre ones uncut. It is stated that those who adopt this system gather an annual crop from the same plants, and the plant itself makes a much more rapid growth. This is reasonable, as it is well known that any plant deprived of its foliage is checked in its growth for some time. But this system is not universally adopted; in some cases the whole plant is cut off at one time, centre leaves and all. These are sorted, or graded, at the mill before treatment.

Where there is a plantation which has been carefully planted out, it is well worth taking every care in preserving it; and by cutting the outside leaves of each shoot, and leaving the three centre ones, less check will be given to the growth, and an annual gathering will be secured. The

leaves should be cut off just below where the green portion terminates, as the soft, thick parts do not work up well with the other portion of the leaf, and have to be recut at the mill before treatment. These, when cut, are bound up into sheaves of a size convenient to handle, and are carted to the mill, where they are sorted out ready for treatment.

THE YIELD.

The officials of the Department of Agriculture, New Zealand, state that, from uncultivated land, from 12 to 18 tons of green leaves per acre are gathered, but from a properly planted and cultivated plantation, according to experiments made, upwards of 50 tons could be gathered, and that the yield of fibre from carefully selected plants would be greater. According to the experience of various mills in New Zealand, it takes from 5½ to 6 tons of green leaves to make one of fibre.

There are various methods adopted in New Zealand of gathering leaves. It is usually from private land that they are obtained, and the owners claim a royalty; in some cases 12s. per ton is paid for the leaves as they are carted to the mill. The cost of cutting and binding is from 10s. to 12s. per ton. In some parts, where the mills are worked in the close vicinity of navigable streams, the green leaf is delivered at a cost of from 20s. to 25s. per ton.

If the yield of leaves is 12 tons per acre, this will give two tons of dressed fibre at £20 per ton	£40	0	0
Cost of leaves delivered at mill—12 tons at 22s. 6d. per ton	13	10	0
	£26	10	0

EXTRACTING FIBRE.

There are two methods of treating this product to extract the fibre—one by machinery, and the other by chemicals and machinery. The latter method has not been used to any extent, but is spoken well of by various writers. That the fibre can be extracted has been proved by me on various occasions. A firm in the city which has taken up the treatment of the Linum flax has produced good samples of fibre from the *Phormium tenax*. But the principal method of extracting the fibre is by machinery, and quite a number of various designs are in use in New Zealand. Most of these do good work. Recently the New Zealand Government gave a bonus for the encouragement of an improved machine, and considerable competition took place.

The commission appointed to examine into the merits of the various competitors have set forth the particulars of each in their report to the Hon. Minister of Agriculture, which is published in pamphlet form and distributed. This is interesting reading to those who contemplate dealing in any way with Phormium. As to the cost of machinery, much depends on the amount to be treated. Some mills are put up to produce several tons of fibre in the week, whilst others aim at smaller productions.

The power employed is an important item in giving the cost of a "treating plant." One capable of producing, say, one ton or so of fibre per week may be set down at from £150 to £200; this is complete, without the power. There are, according to an official publication about 400 mills at work in New Zealand. Some are worked by water power, others by steam, but little can be said of the machinery from the information at present available.

From the experience gained in dealing with the production of the Linum flax, one of the most important features is to show that there is machinery available for its treatment when produced.

VARIETIES.

The following descriptions are taken from Sir James Hector's work:—

"*Harakeke* (Common Swamp Flax).—Leaves coarse, loose, drooping, points generally blunt; flower-stalk large, 11 feet to 14 feet high, and 1 inch to 2 inches in diameter; pod, short, erect. Grows almost everywhere, but attains its largest size (14 feet to 15 feet) on rich alluvial soil, by banks of streams. Many sub-varieties are found, some with dark blue-green leaves above and glaucous below, and some pale olive-green, or bronzy.

COMMON SWAMP FLAX.

Some varieties have also the butts of the leaves coloured with red for some distance up, while others are yellowish-green almost to the very base. When the plant is stunted, the flower-stalk is also small, and the best characteristic is the blunt point to the leaf.

Paretaniwha (Yellow Hill Flax).—Leaves erect, slightly drooping at the tip, yellowish-green, generally with red or orange margins, slightly glaucous below, point acute; flower-stalk small, 4 feet to 8 feet high, and ½ inch to 1 inch in diameter; pod, short, erect; fibre very good, soft and glossy. Plant seldom more than 5 feet or 6 feet in height; grows generally on clay hills.

Tihore.—Leaves stiff, erect, narrow, never drooping at the tip, olive-green, glaucous below; points very acute, or cupsidate, pink at the butt;

flower-stalk, 9 feet to 10 feet high, and 1 inch in diameter; pod, erect or inclined. Seldom flowers, and still more rarely seeds. Plants seldom over 6 feet in height. Grows in rich, dry, alluvial land; never in swampy places. I have never seen it except where planted by the Maoris. I have here applied the name to that variety called "Tihore" by the Maoris throughout the Waikato, and which is probably identical with the "Oue" and "Tapato." It is best distinguished by its narrow, tapering, sharp-pointed leaves and erect, close habit. It grows so thickly together that I obtained 186 sets for planting from two bushes.

Phormium tenax that grows on high or dry ground, though smaller, is in general finer and more easily stripped than that found in swamps. Colonial rope-spinners prefer it, and are willing to give a higher price for it on this account."

HILL FLAX.

The above descriptions are somewhat difficult to follow, as far as identification is concerned. Unfortunately, no care has been taken to retain the names of the varieties introduced here. They have been planted indiscriminately, as they are for scenic effect only.

The illustrations show the variations in the system of growth. They represent plants growing on the St. Kilda road, which were planted by the City Corporation. No. 1 shows the drooping habit, and coarse leaves referred to above, and, no doubt, if it were growing in its natural habitation, namely, on the water's edge, these features would be much more pronounced. No. 2 is typical of the hill variety, being erect, and hardier in its appearance. There are two varieties of variegated flax, but as to their value for fibre production little is known of them here.

PROFITABLE NATURE OF THE INDUSTRY.

The Minister for Agriculture, the Hon. George Swinburne, M.L.A., when visiting New Zealand recently, gave this matter attention. He gives an instance of one land proprietor receiving £9 per acre as royalty for the privilege of cutting leaves from his land. One instance is given in Sir James Hector's publication of 12s. per ton being paid as royalty for green leaves, so that, at the rate of 12s. per ton, and taking the yield at 15 tons per acre, this would give a return of £9.

These figures, possibly, are exceptional. Many instances are recorded of good returns being obtained from the yield of leaves without any effort on the part of the proprietor, and, with proper care in selecting the best varieties in planting, equal or better results could be obtained here.

The value of this industry may be estimated by the latest returns published of the imports of fibre and cordage into Victoria:—

Fibre, from all sources	£79,266
Cordage, binder twine, &c.	41,941
Total	£121,207

The exports of ***Phormium tenax*** from New Zealand totalled £730,803, of which the imports to Victoria of fibre amounted to £25,590, and of cordage and twine to £5,929. The average price of fibre exported from New Zealand during 1905 was £25 17s. 6d. per ton.

CONCLUSION.

In advocating the cultivation of this valuable fibre-producing plant, I feel confident that there is a great future for it, as the growing demand for this class of fibre is considerable. Binder twine alone would justify it being taken up in this State. But every care should be exercised in entering upon this industry, and none but the right class of plants secured, as a mistake in this respect would seriously retard its development.

Large tracts of suitable land are available for this purpose, and, beyond preparing, fencing, and planting, nothing further is needed, except an occasional stirring of the soil. Many of our capitalists, no doubt, would be prepared to take this matter up, if encouraged by some special condition by way of securing land for the purpose. The inquiries for information concerning this matter lead me to believe that something will be done in the way of planting before long, and it would be a mistake to neglect the best advice and assistance available.

THE ORCHARD.

James Lang, Harcourt.

Where the extension of existing orchards, or the planting of new orchards, is contemplated, the work should be taken in hand at once, as the seasonable rains which have fallen all over the State have put the ground in a fit condition for planting operations. In selecting the varieties of fruits to plant, growers should confine themselves to those varieties which succeed best in existing orchards in their respective districts. The orchardist always knows the varieties which succeed best with him, and plants accordingly, but where new orchards are being planted the beginner

may not have that experience, and it would, therefore, be well for him to consult some careful orchardist in his district as to the most suitable varieties of the different fruits to plant.

In planting apple trees, the first consideration should be given to those varieties which are most suitable for export, as the supply of apples for local consumption has now overtaken the demand. Any extension in apple planting should be in the direction of supplying oversea markets. The varieties enumerated are good export apples.

The most popular apple at the present time with the majority of growers, either for export or local market, is the Jonathan. This is a splendidly coloured apple, and of good flavour. The tree is only a moderate grower, however, and as a rule does not grow to a very large size; in some districts the complaint is that it only makes a weakly growth, and soon becomes unprofitable; but in districts where it grows well it should be largely planted. Many of our leading orchardists consider it the most profitable apple to grow. Cleopatra does best in the warmer districts of the State, such as the Goulburn Valley. Growers around Melbourne say that it does not do well with them now, being much subject to the scab—(*Fusicladium dentriticum*). If well sprayed in the spring time with Bordeaux mixture, the fruit would be fairly clean. Where this variety succeeds, it is a most profitable kind to grow; the writer has picked and packed for export eighteen cases from one tree in his orchard. It is also largely grown in South Australia, and is the favorite there with shippers.

Munroe's Favorite is a fine variety. It succeeds well in most districts of the State, and is also a favorite with the London buyers, good samples always bringing top prices. The tree is a strong grower, and soon grows to a good size. It is also a most prolific bearer; an orchard planted with this variety would, in the opinion of the writer, give a better return than any other single variety of apple. Dumelow's Seedling, or Wellington Pippin, is ready for shipping early in the season—*i.e.*, during the month of February. Esopus Spitzenberg is a first-class apple, of fine appearance and good flavour. The tree is a good grower and a prolific bearer.

Sturmer Pippin matures late, and should be sent in the later shipments. This variety is largely grown for export in Tasmania. Rome Beauty is also a good apple for export, and does well in most districts of the State.

London Pippin does not seem to take so well now as it did a few years ago. Large samples of this variety should not be shipped; medium size carry much better. Newtown Pippin is one of the very best varieties, being one of the best-flavoured apples grown. This is one of the leading varieties of apples shipped from America, and commands top prices in the market. It has not hitherto been very largely shipped by Victorian orchardists, but is worthy of extensive planting in districts where the trees do well. Rymer is now being shipped in quantities; it does not seem, however, to take the market so well as the others mentioned.

The varieties mentioned have proved themselves the most suitable for export, and growers who confine their shipments to them will have a good average price at the end of the season. It is far better, and more profitable for orchardists, to grow and export only the varieties which have already made a name in Covent Garden Market than grow those which are not known there.

Citrus fruits should not now be planted, but the trees held over till the early spring, when the temperature is a little warmer.

DISEASES OF FARM ANIMALS.

S. S. Cameron, M.R.C.V.S.

IV.—PREVENTION OF DISEASE.

Breeding—Feeding—Watering—Management—Cleanliness—Disinfection: Fire; Chemical Agents, Fumigation; Physical Agents, Heat, Cold, Dryness, Insolation (sunlight); Mechanical Agents, Filtration, Sedimentation, Ventilation, Perflation, Internal Disinfection, Inhalation—Disinfection of Premises—Disposal of Dead Animals—Isolation—Immunity: Inherited, Naturally Acquired, Artificially Acquired, Virus Inoculation, Anti-toxin Inoculation—Immunity Table.

Just as there are certain circumstances and conditions of body and of environment which tend to the acquirement of disease, so there are certain factors which make for healthfulness, and which, when exerted to the full, have powerful influence in warding off attacks of disease or in mitigating their severity. By the general and continuous practice of hygienic principles and the adoption of methods of adequate sanitary efficiency both the avoidance of predisposing causes and the mitigation of the more marked effects of exciting causes may be compassed.

For the prevention of outbreaks of specific diseases, and of their spread, means special to the disease are adopted. The character of these means will depend largely on an understanding of the nature of the disease, its incubative period, its mode of spread, and other like special features, and will moreover be conditioned in some cases by local circumstances and commercial considerations. They will also depend on the existence of special legislative enactments, and machinery and facilities for administering such. To some extent preventive measures will be indicated in later chapters, when the diseases to which they apply are being dealt with. In this place it will suffice to give short consideration to some of the more important of the many factors which make for general good health and for lessened susceptibility to disease.

BREEDING.

Care in the selection and mating of breeding stock is necessary for the prevention of those diseases which are generally regarded as hereditary. (See page 269.) The breeding from tuberculous cows may, under circumstances specially arranged, be so conditioned that little, if any, risk of the disease being transmitted is run; but under ordinary circumstances the risk of transmission in breeding from tuberculous sires and dams is a large one, and should be unhesitatingly avoided.

Horses affected with any of the following diseases or unsoundnesses should not be used for breeding purposes:—Nasal disease (osteoporosis), rheumatism, ricketts, roaring, whistling, broken-wind, grease, navicular disease, ringbone, bone spavin, bog spavin, thoroughpin, curb, and cataract. It would be well, too, if breeding from stock possessing radical defects of conformation was avoided—such as, particularly, those with calf-knees, bent legs, round gummy joints, flat feet with weak "corny" heels, narrow contracted heels and muley feet, sickle hocks, knuckled fetlocks and long weak pasterns; those "tied in" below the knee and hock, and those which "brush" or "speedy cut."

The supineness of Australian horse breeders generally, and particularly those who have the management of stock shows and stallion parades, in regard to the question of transmissible unsoundness in breeding stock, is

remarkable. It is apparently begotten of that carelessness in the selection of sires and dams which was engendered in the days when horse flesh was a drug in the market. But in these present days, when ordinary sizeable three or four-year-old draught colts commonly fetch £40 to £50, and harness horses are proportionately valuable, it is surely little short of a scandal that prizes are commonly awarded at agricultural shows, which are supposed to exist for the *improvement* of agriculture and stock, to sound and unsound breeding stock indiscriminately. Instances are not wanting, even at the show of the leading agricultural society in this State, in which the blue ribbon has been carried off by an obviously unsound animal, and at some of the provincial shows the awarding of prizes to veritable "crocks" is an occurrence so common as to excite little or no comment. The judges are apt to shelter themselves behind the plea that they are not there to judge of unsoundness, but to be guided by make and shape and suitability only; but surely, in the case of breeding stock, the existence of, say, a spavin or roaring claims consideration under the heading of suitability for the purpose for which the exhibit is intended—viz., the begetting of sound and saleable progeny. At any rate, when, as happened at a leading provincial show in Victoria a short time back, of six horses awarded prizes in two breeding classes, four of them were palpably unsound, the spavin of the first prize thoroughbred and the curb of the first prize draught being distinctly discernible from the ring side, the judges cannot reasonably be acquitted of the charge of abetting in the deception of the breeders of the districts in which the ticketed champions are to be used. Equally culpable were the judges at a recent "National" show, who awarded first to a pronounced roarer, whose "music" could be distinctly heard while he was undergoing the not-too-wind-distressing ordeal of being judged.[1] Such happenings are almost incredible, and are calculated to excite amongst thoughtful men grave apprehension for the future of the horse industry.[2] Ask Indian buyers of extensive experience, or those who were intrusted with the buying of horses for South Africa during the war, as to the numbers of otherwise useful horses that are rejected on account of transmitted unsoundness, and say: Is it not time that prizes, by the gaining of which the average small breeder judges of the merits of the animal, should be awarded only to animals *worthy* of the distinction in *all* respects?

FEEDING.

The most essential attribute of food, in so far as it may be a factor in the maintenance of health, is that it should be sound. Sour milk in the production of diarrhœa in calves, musty hay inducing broken wind in horses, and fermented grains giving rise to indigestion and hoven in cattle, are familiar instances of the ill effects of unsound or decomposing food.

Next to soundness comes the necessity for regularity in feeding, and that the food should be in proper proportion, both as regards quantity and

[1] Apart from the question of hereditary unsoundness, but merely as proof of all-round carelessness in such matters, it may be mentioned that in two successive years at the Royal Show, Melbourne, the winners of Hunter's Plates were palpably unsound "for the purpose for which they were intended"—one had a pronounced bowed tendon, and the other was blind in one eye!

[2] I believe it is true of Australia as a whole, as it certainly is of Victoria, that at no show is the awarding of prizes subject to the condition that the selected exhibits should successfully withstand a veterinary examination for soundness; as is the common practice at leading shows throughout England, to wit:—The Royal, the Bath and West of England, the shows of the Hackney and Hunter's Improvement Societies, and at Islington, and has been recently made the practice in New Zealand. Many of the Australian shows are subsidized by the State, but the condition that Government money or prizes should only be awarded to sound stock has never been imposed.

quality. By the observance of regular hours for feeding animals, and regular and not too prolonged intervals between feeding, a rhythmical action of the digestive organs is engendered, which induces more perfect digestion and makes for disease-resisting strength.

As a general rule, for all herbivorous animals, the advice to feed little and often is good, in that it is in accord with the method of feeding in a state of nature. When such practice is adopted with stabled animals, there is less likelihood of any food being left over, and consequently the tendency to stomach and bowel troubles resulting from the ingestion at next feeding time of soured or fermented food is minimized. Soiled food should always be removed after feeding, and should never be mixed with fresh feed. Complete mastication of the food is necessary to perfect digestion, and in the case of animals with the habit of "bolting" their food it is advantageous to let it be coarser than usual, so that chewing and grinding may be assured.

WATERING.

Very diverse views are held as to the proper time at which animals should be allowed to drink—whether before or after feeding. The most natural plan is to always have water accessible to the animal when in the stable. If this is done, as much water will be taken as is required, and no more, and it will be taken when required, and at no other time. The opinion that water should be given only in limited quantities—limited, too, according to the judgment of *man*—is an error. Animals in health seldom or never take more than they require. It is conceivable that, after long, enforced abstinence, or after profuse perspiration, they require—and take—more than is good for them to take at one drinking—a quantity, indeed, which will, by its volume of coldness, produce stomach or intestinal spasm (colic). In such circumstances it is advisable to interrupt the drinking for a time, or to take the "chill" off the water by warming it slightly, or by adding a little warm water to it. It is well that water should be withheld for some time prior to the imposing of violent exercise or work. Racehorses, for example, should not be allowed water in any considerable quantity during the three or four hours preceding a race. Perhaps the only other time when it is inadvisable to allow a long drink, if it is desired by the animal, is immediately after feeding, when the fluid, passing rapidly through the stomach towards its natural receptacle—(the *cæcum*, or blind gut, or water gut)—is likely to carry with it into the small intestines some of the stomach contents, which are still crude and harsh and not in a sufficiently digested state to pass on, and which, therefore, may irritate the mucous lining of the bowels to an extent sufficient to set up colic, or even inflammation of the bowels (enteritis). For similar reasons, if water is not kept continuously within reach, in which case, as previously stated, as much as will do harm will never be taken, the watering should always be done *before* feeding.

The obviousness of the necessity that drinking water for animals should be pure and wholesome has been previously indicated, when the part it plays in the causation of disease was dealt with. (See page 271.) To insure this, it is often desirable that purification by filtering through natural or artificially-constructed filter-beds, or by precipitating, or some other method of purifying should be resorted to; and the expense and trouble of establishing such precautions will be amply repaid

by the assurance which they afford of the continued health and vigour of the stock. On farms where the water supply consists only of water-holes, which become foul and fœtid from pollution by animal discharges, water troughs supplied by windmill should be provided. The objection is sometimes raised that, where water-holes and swampy patches are numerous, it is of no use providing drinking troughs, as stock will not make use of them; but it will be found *on trial* that stock will always go naturally to clean water. In point of fact, cattle may be frequently observed to refuse, or drink but sparingly of, contaminated water. They may be seen to go to a foul and slimy water-hole, stir the water by wading, then smell it, and drink a little, or wade out without drinking at all. That their thirst is not assuaged is evidenced by the fact that they may be seen to return and repeat the performance time and again. In any case, the fencing off of the water-holes or swamps would be a distinctly profitable undertaking if only as a safeguard against fluke and other such parasites.

MANAGEMENT.

So far as the prevention of disease is concerned, good management includes the continuous provision for housed animals of comfortable quarters and bedding, an adequate supply and interchange of fresh, wholesome air without the occurrence of draughts, suitable clothing, efficient grooming and cleaning, and regular exercise or work in moderation; and for animals in the paddock, in addition to an adequate supply of food and water, shelter, or protection by rugs from wind, rain, and insects and shade from the sun. It will be found, by careful observations over a longer or shorter period of time, that the measure of health or freedom from disease of any stud of animals is in ratio to the amount of care exercised in regard to these items of management.

There are certain times at which extra care in the management of stock is necessary and profitable. Young stock, particularly foals and calves, should be kept growing during their first winter. It is the worst possible policy to let them get low in condition, either from shortness of food or lack of protection from the weather. An ideal winter paddock for young stock should contain a straw stack, whereby both shelter and a picking of dry food is afforded. A check received during the first year is seldom made up for, and it will go hard with under-conditioned youngsters if anything in the nature of contagious disease gets amongst them. Weaning time is also a critical period. Foals should be gradually accustomed to take a little good, hard feed for some time before they are removed from their dams, otherwise the sudden loss of milk will be severely felt.

CLEANLINESS.

Although, perhaps strictly, this should have been included along with management, cleanliness is so much a thing apart in importance from all other factors in the prevention of disease that the strong emphasis of separate consideration is incumbent.

Cleanliness means, simply and essentially, the absence of germs and the lack of means for their multiplication and development. Diseases caused by germs make little headway where cleanliness in all things prevails. Take swine fever, essentially a germ disease, and mark the general experience that, amongst filthily-kept pigs, with rotten food to eat, foul

fluids to drink, reeking air to breathe, and a stinking stye with a filthy floor to lie in, the disease spreads like wildfire, and is proportionately fatal; whilst amongst paddocked pigs, or those attended to wholesomely, and fed on uncontaminated food, in frequently flushed styes, it appears to be almost non-contagious. Similarly with abortion in cattle, strangles in horses, and distemper in dogs, the associated fatalities and "catchingness" are always decreasingly proportionate to the cleanliness of the surroundings.

There is not much more to be said—in fact, nothing more need be said, if the fact has been impressed that cleanliness in all things connected with animals—in their surroundings, their feeding and watering, their housing and paddocking, when working and when at rest—is above and beyond all things the most important factor in the preservation of health and the vigorous resistance of disease, and that it is the essential feature in the subjugation of the spread of infectious and contagious diseases, and of the germs which cause them.

DISINFECTION.

Disinfection is the act or process by which infectious matter is removed or destroyed, and *disinfectants* are the agents used by which such removal or destruction is accomplished.

Fire is the most effective of all disinfectants, and it is taken advantage of in controlling the spread of communicable disease by the burning of carcasses and discharges of affected animals, and of sheds, bedding, manure, litter, soil and like substances with which such animals may have been in contact, or may in any way have infected or contaminated. Fire and heat are also used for sterilizing utensils and instruments, and for purifying water and milk by boiling. Disinfection by boiling, or by exposure to superheated steam or hot dry air is also commonly practised.

Next after fire in effectiveness come various *chemical agents*, the most powerful of which are corrosive sublimate (perchloride of mercury); sulphuric acid and other mineral acids; caustic potash, quicklime, and other strong alkalies; carbolic acid, lysol, creolin, and allied coal-tar products such as phenyle, Jeye's fluid, and Macdougall's dip; permanganate of potash (Condy's fluid); formic aldehyde (formalin); chloride of zinc (Burnett's fluid); sulphur vapour, and chlorine gas. Most of these act by coagulating or chemically combining with the albumen of which the infective germs are constituted, and so destroying them; and, *if they come in contact* with the infective matter, they are as effective as fire. Some of them are powerful caustics, and need to be used with very great care, and diluted to various strengths. Corrosive sublimate is usually diluted to 1 in 1,000 of water (acidulated), carbolic acid 1 in 20, formalin 1 in 40, permanganate 1 in 100, and they are safe and effective in these strengths. The first-named ought not to be used in disinfecting iron, tin, zinc, or leaden utensils, instruments, or materials, as it chemically corrodes these metals. Caustic potash and the milder carbonates of potash of soda have a solvent action on greasy matters, and are hence useful disinfectants in creameries, butter factories, and slaughter-houses. Another property which dictates their general usage at such like premises is their freedom from smell. Carbolic acid, chloride of lime, formalin, and other substances having a powerful and penetrating odour should not be used where food materials, and especially milk and its products, are being manufactured, prepared or stored. Quicklime, in the form of lime-wash and as a powder,

has been largely used, and is in great favour as a disinfectant of sheds, floors, ground surfaces, cesspits, and the like; but its efficacy as a destroyer of disease-producing germs is doubtless largely problematical, and when used as a lime-wash it is always a safe precaution to strengthen it with an effective proportion of carbolic acid, permanganate of potash, or other reliable disinfectant.

Experiments recently carried out by Mr. J. A. Gilruth, M.R.C.V.S., the chief of the New Zealand Government veterinary staff, would appear to indicate that lime is useless as a reliable disinfectant for bones, soils, and paddock surfaces in such diseases as anthrax. He mixed crushed bones known to contain spores with an equal quantity by weight of quicklime by grinding them together in a mortar. Sterilized water was added to slake the lime, and the mixture set aside in sterilized bottles for a week. At the end of that time the lime was washed away from the particles of bone which were then placed in culture media. Just as luxurious a growth of organisms resulted as did from control cultures which had not been treated with lime. Gilruth claims that, although in this experiment the germs were *within* the substance of the bones treated, the test was a fair one, in that the lime was as likely to get to a germ in a small ⅛-inch cube of bone as to germs in larger bones, or in hard, clayey nodules of soil, and he points out that, while, at a pinch, equal parts of lime might be added to bones to be disinfected, it would be impracticable to treat the soil with equal parts of quicklime.

So far as concerns the disinfection of bones containing anthrax or other disease germs (and bones imported from India and elsewhere have been responsible for a number of outbreaks of anthrax in Australia and New Zealand during recent years), there are only two effective methods which can be practically applied without commercial loss. One is treatment with sulphuric acid, whereby the bones are chemically converted in soluble superphosphate of lime, the germs being destroyed in the process; and the other is exposure for a few hours to superheated steam, under pressure, whereby the heated steam is forced into the substance of the bone particles, and so contacts and destroys the contained germs.

Of *physical agencies* which act as disinfectants, heat, cold, dryness or desiccation, and sunlight or insolation are the most important. *Heat* has already been adverted to. *Cold* is less effective than heat, but the activities of germs are in large measure destroyed by exposure to a degree of cold, at or below freezing point; or, if the exposure is prolonged, even at a temperature somewhat above freezing point. Just as moisture is essential to the life of germs, as of all living things, so *dryness*, or *desiccation*, is inimical to their development and growth; and hence a long period or an intense condition of dryness, contributes to the destruction of germ life. For the same reason, disinfection is effected by *sunlight*, or, more correctly, by *insolation*, by which is meant exposure to the sun's rays—the actinic (or chemically active) rays probably, rather than the light rays necessarily. The "sweetening" effects of sunlight are well known, and it would be advantageous if the opportunity were more frequently given for the penetration of sunlight into stables, byres, kennels, and styes.

Of *mechanical means* of disinfection, *filtration* and *sedimentation* are processes by which germ-laden water may be purified, and in this sense they may be regarded as disinfection methods. So also the flushing with

water of drains, floors, walls, and fittings, in so far at it effects the "cleansing" of these or the removal from them of infective matters, may be considered a means of disinfection. In the same sense, *ventilation*, by effecting exchange of air. and *perflation*, or *air-flushing*, by causing the removal of stagnant, devitalized, vitiated, or germ-laden air from a building are auxiliaries to efficient disinfection which should never be neglected.

Internal Disinfection. — Disinfection of the respiratory passages by *inhalation* will be referred to when treating of the parasitic and other lung diseases, but it may be said here that attempts at internal disinfection of the body by the introduction of agents into the alimentary canal, or into the blood direct, have up to the present been illusory; at the same time it would be rash to say that there are no grounds for hope that such a means of protecting the system may be successfully accomplished in the near future.

DISINFECTION OF PREMISES.

The method of disinfection of buildings, yards, and paddocks to be adopted as a means of preventing the extension of communicable disease will depend largely on the nature of the disease and its manner of spreading, whether its cause is a fixed contagion or a volatile or floating infection —that is, whether it is usually conveyed by direct or intermediate contact, as with the contagious anthrax, or by atmospheric contamination also, as in the infectious pleuro-pneumonia.

The period of incubation, by which is meant the time during which, after infection, the disease remains latent before the appearance of symptoms, and the channel of infection—whether by ingestion, inhalation, or inoculation—are also matters which must be taken into account in determining the method of disinfection to be carried out.

When dealing with a so-called infectious disease—that is, where atmospheric contamination or infection has to be counteracted—fumigation of all closeable buildings should be performed. It is necessary, for effective fumigation, that all openings into the building should be effectively closed. Bags may be stuffed into air-holes, louvres, and other openings; and cracks and crevices in doors, floors. and ceilings may be pasted over temporarily with paper. The process will be best illustrated by instancing fumigation with sulphur. Rock brimstone or flour of sulphur is ignited and kept burning by different means, perhaps the most convenient and successful of which is to place the ignited sulphur on an iron plate or shovel, kept at a dull-red heat by the flame of a burning lamp or gas-jet underneath. It may also be vaporized by placing it on top of a layer of live wood or coal ashes on a shovel or iron plate. The building should be kept closed for a period of one or two hours after the sulphur has been burnt. Five pounds' weight of sulphur completely burnt is sufficient to thoroughly disinfect a shed containing 1,000 cubic feet of air space—that is, a building 10 feet by 10 feet by 10 feet. This seems a large quantity of sulphur to use, but accurately-conducted experiments have shown that anything less than 5 per cent. of sulphurous acid gas (SO_2) is inefficient for the destruction of disease germs. If steam is liberated into the compartment at the same time as the sulphur gas, then half the quantity of sulphur will suffice, as the germicidal effect of the gas is more pronounced in the presence of moisture. On the whole, perhaps spraying with formalin is the most effective method of aërial disinfection. A 3 per cent. solution in water is used,

and the finer the spray, and the greater the force with which it is projected into corners and crevices, the better.

Additional measures for the disinfection of buildings comprise the removal of all loose fittings, and the burning of such as cannot be thoroughly cleansed and disinfected with boiling water or otherwise; the burning of all refuse, litter, sweepings, or other *débris* likely to convey infection; the thorough scraping, scouring, and cleansing of walls, floors, ceilings, fixtures, and under side of roof with hot water and soft soap; and the swabbing of all such with a strong disinfectant solution—1 in 1,000 of corrosive sublimate, or 1 in 20 or 40 of carbolic acid, creolin, phenyle, Jeye's fluid, Macdougall's dip, chloride of lime, or caustic soda, in such a way that all crevices and corners and projections are reached by the fluid. The walls and floors may then be painted, or lime-washed with hot carbolized quicklime, or coated with heated tar.

Yards, if paved, shoud be flushed and brushed with a corrosive sublimate solution. If the floor is of earth, the surface mud or soil, to a depth of 6 inches or more, should be spaded off, removed and burnt. The bared surface should then be charred by covering with straw or litter, sprinkled with kerosene, and fired. A thick dressing of quicklime may be applied, and the surface made up with fresh, clean earth, well rammed and graded.

Drains.—Surface drains should be first swept clean, and copiously flushed with water, then flushed with corrosive sublimate solution, and afterwards made impervious by coating with heated tar. The disinfection of underground drains presents greater difficulties. They should be scraped, if possible, and then slowly flushed with a strong solution of caustic potash or caustic soda, after which flushing with water and corrosive sublimate solution may be carried out.

Fences and *walls* of post and rail, pickets, brick and corrugated iron, may be effectively disinfected by first removing all dirt and then swabbing with corrosive sublimate solution, and afterwards coating with hot carbolized lime-wash or with hot tar.

Paddocks are difficult to disinfect, and little effectiveness attaches to the plan usually adopted by treating them with dressings of lime. The only really reliable measure is the giving over of the paddocks to cultivation for a series of years; but, if this is impracticable, the paddocks should be rested until a crop of grass or cereal has been grown, which, when dry, should be fired. Hollows and depressions may be given a heavy lime-dressing with good effect, or they may be sprinkled with carbolic or corrosive sublimate solution. In all cases the surface should be exposed as much as possible to the full effects of a summer's sun.

Water-holes.—The disinfection of water-holes and tanks is likewise a difficult matter. Little more than emptying, cleaning out the mud and sedimentary matters, and dressing the sides and bottom with quicklime or sulphate of iron, can be attempted; and the best plan to adopt in regard to a water-hole known to be infected is, after carrying out the above measures, to fence it 'round so as to prevent access of stock for a period of about twelve months, by which time, so far as concerns most communicable diseases, the danger of infection will have been reduced to a negligible degree.

Finally, all buildings, yards and paddocks which are known to have become infected with disease germs should not be used for the housing, holding or grazing of any animals of a kind liable to contract the particular

disease in question for a varying period, depending on the virility of the specific germ concerned; and before their ordinary use is resumed they should be tested by allowing susceptible animals of low value to be placed in them for a length of time sufficient to cover the incubation period of the disease.

DISPOSAL OF DEAD ANIMALS.

Closely allied to disinfection is the question of the disposal of the carcasses of dead animals, paricularly those which have been affected with communicable disease.

In Australia there is happily no necessity to discuss the merits of burial *versus* cremation. Except in the large cities, where animal carcasses are usually dealt with at boiling-down or destructor works, there are, as a rule, ample facilities for the burning of carcasses, and this method of disposal is usually adopted—that is, when any method is adopted. For it is unfortunately the case that in many instances no attempt is made to dispose of carcasses; they are simply allowed to rot in the sun where they lie, and are often thus a bountiful source of contamination of water-holes, creeks, and other water supplies. In times past, in regard to pleuro-pneumonia, and even down to the present time in regard to anthrax, this criminally-neglectful custom has been largely responsible for the persistence of these diseases on some properties and along certain of the main stock routes.

A hint as to the construction of the cremation pyre for a bullock or horse may be of service. Immediately alongside the carcass a trench 2 feet wide, 2 feet deep, and 6 or 8 feet long, shallowing towards the ends, should be dug, and filled level with wood. On this and on the adjacent ground at the sides a foot-thick layer of long wood should be piled, and the carcasses rolled on to it and covered above and all round with a sufficient quantity of wood. A sprinkling of kerosene or tar to start the blaze, and replenishment of the wood as required, will complete the job. The advantage of the trench is that it obviates the necessity of lifting the carcass, and as the wood in it burns away, it acts as a draught flue to expedite the combustion and render the cremation complete. Any of the surrounding ground surface that is soiled or soaked with blood or discharges from the dead animal, should be spaded off and thrown on to the fire, and in the case of communicable disease it is also a wise precaution to char the ground for some distance round by sprinkling with kerosene and firing. Whenever possible, carcasses should be cremated where they lie, without removal. Removal always means additional contamination of either vehicles or ground, and this involves extra trouble and expense of disinfection, and increased risk of spread of the disease.

If for any reason burying the carcass is resorted to. the grave should be sufficiently deep that every part of the animal may be at least 3 feet below the ground surface. This will require that the grave be dug at least 6 feet deep. The elbow and stifle joints should be cut through (except in the case of anthrax carcasses), so that the limbs may fall down and fold in to the body. The surface soil on which the carcass has lain should be dug over, plentifully mixed with quicklime, and thrown into the grave round about the carcass before the remainder of the soil is filled in.

Sometimes in the vicinity of chemical manure works, treatment with sulphuric acid is adopted as a means of disposal of carcasses, but, as a rule, destruction by chemical means is impracticable, and expensive beyond warrant.

Disposal of carcasses by treatment in a destructor, or by boiling down, is frequently resorted to where establishments for the carrying out of such procedure exist near by. Considerable returns may be got from the resulting fat, bones, gelatine, manure and other products, especially in the case of well-conditioned horses and fat cattle or pigs; but where a communicable disease is being dealt with, care needs to be taken that all parts of the carcass, including the skin (which it is better to burn), should be treated, and so rendered innocuous. The vehicle in which the carcass is conveyed to the premises, and all appliances on the premises brought in contact with the carcass, will also require to be efficiently disinfected.

ISOLATION.

Isolation, as a means of preventing the extension of communicable disease, means the separation of the unaffected from contact, both direct and intermediate, with affected animals. The converse plan of removing the diseased animal from the midst of the healthy is a grave mistake, in that it involves the contamination of the hitherto clean buildings, yards, and paddocks to which such diseased stock is removed.

If the animals being dealt with are housed, it is necessary that the buildings in which the diseased animals are should be completely disconnected by drains, air openings, doorways, windows, and in every other way, from any building used for other animals subject to the same disease. If not housed, then the isolation yard, paddock or enclosure must be surrounded by a roadway or double fence, or by other yards, paddocks or enclosures, in which no animals of the same kind are kept; and no communication by drains or other waterways from the isolation paddock must be allowed to exist.

In dealing with infectious diseases—that is, those in which an infected atmosphere may be a means of communication, isolation is not always efficacious, but with purely contagious diseases—those requiring contact for infection—it may usually be relied on. In the latter case, care must be taken that contact does not take place by any intermediary, such as attendants or their clothes; other animals, including rabbits, rats and mice; water; drainage; bedding; utensils, or the like means. Intermediate contact by means of flies and insects is difficult to prevent, but, excepting tick fever, in most cases the probability of such a method of transmission, in Australia at all events, may be considered as remote.

IMMUNITY.

The possession of immunity against, or insusceptibility to, any particular disease is an effective preventative of that disease. Such possession of immunity may be either inherent to the species, or it may be acquired, naturally or artificially, by the individual.

Inherent immunity is possessed by *all* species of animals to *some* diseases. Man is immune against blackleg of bovines, horses against diphtheria of man, cattle against bubonic plague, pigs against scarlet fever, and dogs against typhoid fever. Again, take the diseases of small-pox of man, strangles of horses, contagious pleuro-pneumonia of cattle, lymphatic abscess of sheep, swine fever, and canine distemper. In all these cases the disease is peculiar to the species mentioned. None of them ever affects animals of any other species, which are therefore said to have an inherent or possessed immunity against them. Why certain species or kinds of animal are never

attacked by certain diseases common in other animals similarly circumstanced is a problem that has not yet been satisfactorily solved. It is speculated, however (on the basis of experimental evidence, a large amount of which has been recorded during the past decade) that this natural immunity may be found to depend on four principal agencies, any one of which may possibly determine the insusceptibility as regards some species and some diseases, but all four of which are doubtless factors in the majority of instances of immunity. These agencies are—(1) *Body temperature:* The high temperature of birds normally would appear to account for their resistance to anthrax invasion, for when the body temperature is kept continuously reduced by artificial means, such as immersion in cold water, birds become liable to anthrax equally with other animals. (2) *Germicidal substances* present in the blood serum of the insusceptible animal. Horses are found to possess normally a certain quantity of diphtheritic anti-toxin circulating in the blood. (3) The phenomena which led to Metschnikoff's theory of *phagocytosis*, by which is meant the selective destruction or devouring of particular invading germs by the white blood cells. (4) The *chemical constitution* of the fluids and tissues of the body.

Acquired immunity may be naturally or artificially acquired. The protection afforded by one attack of a disease against subsequent attacks of the same disease is perhaps the best-known illustration of *naturally-acquired immunity*, although the immunity possessed by matured animals against diseases which only develop in the young is also a fairly common instance of the natural acquirement of immunity. Such immunity may be permanent for life, as after strangles in young horses or blackleg in calves, or may be more or less temporary, as is seen in the recurrence in the same animal, at varying periods of remoteness, of tick fever in cattle or swine fever in pigs. One of the first theories advanced to explain this acquirement of protection, whether permanent or temporary, was known as the "pabulum" theory. It was assumed that there was in the system some special substance necessary for the existence of the invading germs, and that this substance, or food, or pabulum, was eaten up or exhausted during the progress of the first attack, and that, therefore, the system was thereafter, either permanently, or temporarily pending slow replenishment, devoid of the material essential to the support of the germ concerned, which consequently, on being introduced to a "recovered" system, could not grow, or multiply, or exert its disease-producing effect. Another hypothesis, and one which was also held to account for the three stages of fever—the premonitory stage, the crisis, and the decline—assumed the excretion by the germs themselves, when active, of a material which was inimical to their further growth and development. In other words, it was assumed that the products elaborated during the activities of germs were poisonous to the germs, and destroyed them, and also any others of the same kind which gained access subsequently—just as the sewage and nightsoil of a town, if not removed, would become fatal to the inhabitants, and when they were decimated would prevent the further occupation of the town by others. Specious as were these speculative explanations, and as were also others that have been advanced from time to time, there were many counter-arguments of a practical character, and it was found that they would not, except incompletely, stand the test of experimental proof.

No reasonably sound explanation, based on experimental evidence, was forthcoming until the development by Metschnikoff of his *phagocytosis*

theory, which has been previously referred to. His investigations showed that the invasion of the system or a part by disease germs induced an enormous increase in numbers of the white cells of the blood, which attacked and destroyed the invading germs. From these facts he deduced that protection against subsequent invasion by the same kind of germ would follow by the preparedness of the system to quickly elaborate an immense force of defending white blood cells, to which, when concerned in this work, he gives the name of "phagocytes." But it would appear, from the still more recent researches of Behring, Katisata, Ehrlich, and others, that Metschnikoff's phagocytes are not the only defenders at hand, but that, in addition, there is a power possessed by the tissues to form, when attacked by disease germs, certain substances called "Anti-toxins," which have the power of antagonizing or neutralizing the toxins or specific poisons produced by germs. It is the toxins or poisons excreted by germs which have the death-dealing properties, and not the germs themselves, and when these toxins are neutralized by the formation of anti-toxin, recovery takes place, and the system apparently retains the protective influence of the anti-toxin or acquires the power of producing it for a greater or lesser period of time or for all time, and is consequently immune against another attack, either temporarily or permanently, as the case may be. The phenomena of toxins and anti-toxins are more marked in some diseases than in others.

Artificially-acquired immunity is brought about by a process of protective inoculation. It has been the habit to apply the term "vaccination" indiscriminately to all methods of protective inoculation, but this term refers particularly to the use of vaccine in protective inoculation against small-pox. A better term is the apt and recently-coined "jennerization,"[1] by which is meant the inoculation of any material with the object of protecting against disease. The process consists in the injection or introduction into the system of (*a*) material (virus), which will set up an allied disease or a mild form of the disease to be counteracted or (*b*) material (anti-toxin) which will counteract or antagonize the toxins produced by the causative germs of the disease.

Virus Inoculation.—In carrying out the first of the above methods, viz., the introduction of a virus for the production of artificial immunity three schemes may be adopted—(1) The inoculation of the ordinary virus of an allied but milder disease, as in the case of vaccination for small-pox in man, in which case the benign cow pox virus is inoculated to protect against the virulent small-pox. In animals the inoculation of avian tuberculosis for the immunization of cattle against bovine tuberculosis is a similar instance. (2) The injection of a weakened or attenuated virus of the same disease to produce a mild and controllable attack of the disease, and so protect against a natural and virulent attack. For example, the use of anthrax virus attenuated by cultivation in an oxygen atmosphere to protect against anthrax invasion. (3) The introduction of the ordinary or full-strength virus of a disease at a part anatomically remote from the natural seat of the disease, and into tissue histologically different from the tissue naturally invaded, whereby a local manifestation of the disease is produced, which can be confined to the adjacent parts, or the spread of which can be controlled. This is exemplified in the practice

[1] After Jenner, who, in regard to small-pox, was the first to introduce the practice of protective inoculation, and who is justly entitled, by the adoption of the term "jennerization," to have his name immortalized as the "father" of the system.

of inoculating cattle for pleuro-pneumonia, when pleuro lymph from the lungs or chest cavity is introduced beneath the skin near the tip of the tail, where it sets up a local inflammatory lesion which, except for the modification occasioned by the difference between the tissues of the tail and lung tissue, is in every way identical with the lesions in the lungs in pleuro-pneumonia, and which does not usually spread beyond the tail, just as pleuro-pneumonia itself does not spread usually beyond the lungs.

Anti-toxin Inoculation.—For the production of artificial immunity by the second method—that in which anti-toxin or anti-toxic material is injected into the blood—the material so injected may be produced by—(*a*) Artificial means, as when anti-diphtheritic serum is produced in the blood of horses; or (*b*) advantage may be taken of the fact that it may be procured from an animal in which it has formed naturally during the currency of an attack of the disease, as when "recovered" blood (*i.e.*, blood from an animal which has recovered from a virulent attack) is injected as a preventative of tick fever, or when bile from an animal suffering from rinderpest is used to protect other animals against an attack of that bovine scourge.

IMMUNITY TABLE.

Immunity

- Inherent
  - Chemical constitution of tissues
    - Man insusceptible to blackleg of cattle.
    - Horses insusceptible to diphtheria of man.
  - Phagocytosis
    - Cattle insusceptible to bubonic plague of man and rodents.
    - Pigs insusceptible to scarlet fever of man.
  - Blood germicide
    - Dogs insusceptible to typhoid fever of man.
  - Body temperature—Birds immune to anthrax.
- Acquired
  - Naturally
    - Permanent
      - previous disease
        - Blackleg in cattle.
      - age
        - Strangles in horses.
    - Temporary
      - previous disease
        - Swine fever—about six months immunity.
        - Tick fever in cattle—about one year's immunity.
  - Artificially
    - Virus inoculation
      - (*a*) Remote inoculation of full-strength virus, *e.g.*, pleuro lymph in bovine pleuro-pneumonia.
      - (*b*) Attenuated virus of same disease, *e.g.*, oxygen attenuated cultures for anthrax in sheep and cattle.
      - (*c*) Virus of allied disease
        - Avian tuberculosis for tuberculosis of cattle.
        - Cow-pox vaccine for small-pox in man.
    - Anti-toxin inoculation
      - Artificially produced, *e.g.*, Anti-diphtheritic serum from horses repeatedly inoculated with diphtheria cultures.
      - Naturally occurring
        - In the bile of rinderpest-affected cattle.
        - In the blood of cattle recovered from tick fever.

The preparations of the viruses and anti-toxins just referred to will be dealt with when the diseases which they concern are considered; but it may be here stated that anti-toxins of certain diseases have been shown to exist in the bodies of animals which are inherently immune to the disease. For instance, horses have in their blood-serum the anti-toxin of diphtheria, against which disease they are immune. It is also found that anti-toxins are developed in the blood-serum of animals into which the germs of a disease to which they themselves are not liable are introduced, so that, by repeated inoculation of the horse with the virus of human diphtheria, an increased quantity of diphtheritic anti-toxin is developed in the blood, and may be extracted in the serum and used for the prevention and cure of diphtheria in the human being. Similarly anti-streptococcic serum for the prevention of abscess formation is got from an animal into which repeated doses of streptococcic cultures have been injected.

I have thought that the consideration of the subject of immunity might be made to lend itself to perhaps more graphic expression in tabular form, and for the better fixing in the mind of the above exposition of an admittedly intricate problem, the phases of which are varying from day to day, I have devised the table shown on the opposite page.

EXAMINATION FOR DAIRY SUPERVISORS, MAY, 1906.

REPORT BY THE BOARD OF EXAMINERS.

(T. Cherry, M.D., M.S., S. S. Cameron, M.R.C.V.S., R. Crowe, and J. Hancock.)

The first examination for the appointment of supervisors under the Milk and Dairy Supervision Act has just been completed. Two hundred and sixty candidates presented themselves for the examination, and 22 passed. As these examinations will be held at least once a year for some time to come, we think it advisable to publish the following report, which may be of service to future candidates. The examination was divided into three parts—written, oral, and practical—but, in accordance with the spirit of section 9 of the Act, we did not reject any candidate on the written paper alone. We append the questions at the written examination, and one of the best sets of the answers received. These answers are not to be taken as models in all respects, but they will serve to indicate the average standard which every candidate should aim at.

When the Act comes into operation, no modification of its provisions will be allowed. Supervisors appointed by, and responsible to, the municipalities will require to have the same qualifications and pass the same examination as those acting directly for the Department of Agriculture. The main object of the Act is to introduce a large measure of technical education for dairy farmers. Instead, for instance, of supervisors being armed with powers for simply rejecting cream unfit for consumption at the factory, their duty will be to trace it back to the farm, find out and explain to the farmer the cause of its unfitness, and try to induce him to adopt better methods of production.

The Act lays it down definitely that before a man can be appointed as a supervisor, either by a council or the Minister, he has to give satisfactory evidence that he has had *bonâ fide* practical experience in dairying and the allied branches of agriculture, and amongst animals. As examiners, we have interpreted this to mean that it is no use passing a man through the theoretical portion of the examination in the hope that he will gain practical experience afterwards. We laid it down as a rule, in examining candidates, that a man's answers must furnish evidence that he had had practical experience in dairy farming. Suppose a man in the course of examination claimed to have a knowledge of butter manufacture, but had perhaps never seen a butter factory, it would not be long before we would discover that he was solely "book learned" and had had no practical experience of the subject regarding which he claimed knowledge. This process of examination has thrown out the theoretical, or "book," man from the start. The next thing we looked for was a fair general education. In a good many cases we found candidates were so poorly educated that they spelt "*as*" "*has*," and *vice versâ*. We instance this as showing one type of man going up for examination. Although such a lack of education was so manifest, and might have justified us in throwing a man out on the written paper, we allowed him to come to the oral and the practical examination. In every case we had no difficulty in finding that he was weak in his dairying and agricultural knowledge also. It was therefore easy to reject him. Men of this type who have attained the age of 30 or 35 years are hardly the class of men who will make successful supervisors. It shows they have not understood the importance of education, and unless a man has enough grit in him to realize that education nowadays is one of the main factors in life, we hardly think we could reasonably expect he would prove to be the type of man we were looking for. We required, first, practical experience; second, general education; and, third, sound common sense and tact, with a knowledge of the underlying principles of agriculture—men who could not only do a thing, but who could say why they did it, and who were also able to explain their reasons lucidly to a farmer. For instance, when we asked why lucerne hay was of more value to the dairy farmer than, say, mangels, we did not expect him to go into elaborate details as to the amount of protein the hay contained. We expected he would give an answer more after the style of that printed below.

With regard to the practical examination, the first thing that struck us was the large proportion of the candidates who had been labouring under the great disadvantage of having received no special instruction in farm methods, and in matters which are of importance to every farmer. A large number exhibited a great lack of discrimination between the little unimportant details and the great principles of which every one should have a firm grip. Many of the candidates were men of a decidedly superior type; they were far and away above the average young farmer. Most of the candidates were men between 25 and 40 years of age. As examiners, the impression we obtained, after hearing the experience they had had on their own farms, was that there are a large number of farms in Victoria where sound methods are being carried out, and which may very well serve as models for the neighbourhood. Few candidates had had any guidance with regard to their ways of thinking. Their facts have been accumulated from experience, but their judgments in most cases have been formed wholly without having any one with whom they

could discuss the facts they had been thinking about. Another type we met with was a man who had got hold of a fair number of facts which were correct, but at the same time was hugging a number of delusions and calling them facts. This was apparently chiefly owing to the disadvantage of not having had any one to assist him in sifting the true from the false. Very often he was cocksure about being right, when, as a matter of fact, he was absolutely wrong. In dealing with men of this kind we were largely guided by their type of mind. If we found a man was in the habit of thinking, and reflecting and bringing common sense to bear on his answers, and if he was willing to admit he was mistaken, we sent him on for further examination; but when we met the type of man who was wrong in a good number of facts, who was absolutely sure he was right, and who would not admit that he might be mistaken, we simply rejected him at the oral examination. He is not the man to make a good supervisor. At the abattoirs we threw out a man for the reason that, although, as far his knowledge was concerned, he was up to the average of those who passed, yet there were points about his methods that were fatal. In examining one of the cows he percussed it, and when asked what he could hear he said he had a bad cold, and could not hear anything. Later on we asked him to give instructions to the attendant as to what to do when cleaning the yards after leaving the place. There had been a number of cows suffering from tuberculosis and other infectious diseases in the pen, and in examining the animals he had got a fair amount of infective material on his hands. He gave excellent instructions as to what was to be done with the floors, but before he finished speaking to the attendant he picked up his coat and put it on without washing his hands, or taking any further thought, showing there was a lamentable lack of harmony between his theory and practice. At a later stage, although he was unable to tell what some ordinary specimens were, he remarked that he would guarantee he could diagnose by *post-mortem* appearances anthrax, with any man in Australia. There is no man who can diagnose anthrax simply by a *post-mortem* examination. These incidents revealed the type of man we had before us, and we were unable to let him go any further. A number of candidates were foolish enough to pretend to a knowledge or experience that they did not possess. This was particularly the case with those who attempted to "sound" a cow's chest by auscultation and percussion. The sort of man who would be unwise enough to try to delude his examiners would scarcely to reliable in his intercourse with farmers or in the carrying out of the responsible duties imposed on supervisors under the Act. Some candidates, although they got up their work well, displayed a great want of reliance on the methods they were advising. For instance, we would ask a man what he would do with a pig, which had died of swine fever. He said he would tell the farmer to burn it. We asked him what about the ashes of the pig. He said he would tell the farmer to bury the ashes 6 feet deep, and put a bag of quicklime on top of them. It was obvious he could not have much faith in his burning if the ashes needed to be so carefully dealt with. What we objected to was a man giving elaborate instructions of that sort, and not being able to justify his action in putting the farmer to such a lot of unnecessary work. Unless candidates have their knowledge balanced, it is quite certain that if they are turned loose amongst the farmers as supervisors, they will bring ridicule upon the whole administration of the Act. Now, the most

important thing in the practical examination is care in arriving at conclusions. Take, for instance, the examination of cows. We want a man to look at them carefully all over, and, while we do not expect every one to give them the same overhauling as a veterinary surgeon would, we want them to be examined so carefully that none of the big outstanding points are missed. A good many candidates simply looked at the cow from one side only, or noted some prominent point, and then jumped at a conclusion. At the practical examination it was simply surprising the number of men who failed to observe that two of the cows examined on had blind quarters. On the other hand, there were some who displayed great care in arriving at the facts of the case. When shown a simple case, which one would have thought could have been recognised at a glance, they looked into it carefully, touched and handled it, and thought about it before saying what it was. They exhibited equal care with the difficult specimens, and simply from the way in which they looked carefully into all the facts, and turned over these facts in their minds before coming to a conclusion, we felt they were exactly the type of men to induce farmers to improve their methods.

Amongst the older men who presented themselves we found that the great stumbling block to their becoming good supervisors was their inability to give up cherished fallacies. They relied largely on their experience of methods that were oftentimes obviously improper. Many of them gave us the impression that they would have a lot to unlearn, and that the unloading of their present conceptions would be but slowly and reluctantly accomplished.

We hope in the future to make the examinations even more practical than they are at the present time. Instead of confining the practical work to the examination of live animals and dead specimens, we hope to be able to make arrangement, by means of which we will have facilities on a good farm to give every one who goes up for examination an opportunity of showing what he knows of all the operations connected with farming. For instance, we would like to see how some candidates set to work to wash a cow's udder. From the way in which the question was answered, there seems to be a great difference of opinion existing in the minds of many as to the proper way of doing a simple thing like this.

For the information of any who are thinking of going up for future examinations, we would like to mention a few points. The type of man we want as supervisor, with the experience he has behind him, should be too good to remain the whole of his life at £150 or £200 a year. The Department has announced that in the case of good service and progressive efficiency it will raise the salary of a supervisor £25 a year. So far a maximum salary has not been fixed. Under the provisions of the Act it will not be possible to go much above £200, otherwise the expense to the farmer would be too great, because the salary has to be covered by the fees. We want men who look forward to being dairy farmers themselves, and who will make their farms models for the surrounding districts to copy.

Owing to the fact that the first examination had to take place within four months of the time that the Act was passed, it was practically useless for the Department to attempt to do anything in the way of arranging for the tuition of candidates. The amount of polish you can give to a

candidate in two or three months is not of any great importance in an examination of this kind. Now that the first examination is over, and as examinations will recur at regular intervals from this time forward, it has been felt that some steps should be taken to institute classes for the necessary teaching in the principles which underlie sound dairy farming practice, and instruction in the most important parts of the routine duties which supervisors will have to undertake. The Department has accordingly opened up negotiations with the University to arrange for carrying out this side of the education of the supervisors, and a five months' course of instruction will be established almost immediately This instruction will embody the practical work of the dairy farm, the main points connected with bacteriology, physiology, and veterinary work, and the hygiene of the farm. These subjects will be treated by lectures and demonstrations very much in the same style as those held in connexion with the bacteriology classes for butter factory managers. We hope that by this course the candidates who have already had a good practical experience will be more thoroughly equipped from every stand-point, and better prepared, not only for the examinations, but for undertaking the active work of supervisors as soon as they may be appointed under the Act.

NOTE BY MR. HANCOCK.

As the one examiner outside the Department of Agriculture, I would like to add my impressions of the examination and its possible results.

Like a number of the farmers of the State I had been imbued with the idea that the dairy farmers had much to dread from Government dairy inspection, but, after being in close contact with the officers of the Department during a very arduous fortnight, and ascertaining what their aims are, I am now convinced that if the supervisors do their work in accordance with the wishes of the Department they (the farmers) will have nothing to fear.

One good point is that whether the Act is carried out by the Department or by the municipal councils, there will be uniformity of inspection.

QUESTIONS AND ANSWERS.

Question No. 1.—*State, in detail, why it is advantageous to cool and aerate milk for a town supply immediately on being drawn.*

Milk as it is drawn from the cow contains a large number of substances of a volatile nature, which depend largely upon the variety of feed she has been eating; for a number of foods give a characteristic, and in some cases disagreeable, odour and taste. In addition to these, there is the characteristic animal odour itself dependent upon the cow, in some cases very strong and objectionable. All these are volatile, and if the surface of the milk can be increased and brought in contact with the air, these substances volatilize or pass off readily, and leave a pure tasting and smelling milk. This condition can be brought about by aerating the milk over a special apparatus, with which is conjoined the power of cooling.

This cooling is particularly advantageous, for the temperature of fresh milk is one in which lactic acid bacilli are active, and the milk will thus

more quickly turn sour, or at least have a greater acidity than that allowable. By cooling the milk the development of these bacilli is checked, and if the milk can be kept at a low temperature until delivery very little acidity will be present, and practically sweet milk will be delivered. So far, at least, as children are concerned, this is most important.

Question No. 2.—*Describe the essential features of the floor of a byre or cow-shed. (Rough drawings should be given to illustrate your answer.)*

The essential features of the floor of a byre are—(1) That it shall be impervious to moisture; (2) that it should be perfectly drained and easily cleansed. The method of obtaining the first depends upon the material available in the district, and may be either bricks well set in cement, pitchers, or stones available set in cement, and levelled off with a surface coat of the same material, or tar and sand, or a floor of wood, set and covered with the same materials, may be used.

The second is obtained by grading. The stalls should have a slight fall from front to rear, then a sudden drop should be given to form the gutter, which should have a fall of about 1 inch in 20 feet from end to end of the shed to the outlet. From the wall of the drain a gradual rise should occur to the crown of the passage behind, as shown in the diagram No. 1, or the drain may have a square bottom, as in No. 2. For double rows the same scheme should be carried out on the other side.

Whatever system is followed, it is essential to have a firm foundation of puddled clay, if possible, with a good solid layer of stones, concrete, &c.

(Explanatory sketches accompanied this answer.)

Question No. 3.—*What are the most common causes of a sudden and considerable diminution of milk yield in a herd of cows?*

The most common causes of a sudden and considerable diminution of the milk yield in a herd may be—Sudden changes of weather and exposure to cold; sudden change of feed; eating deleterious material; excessive excitement, as by being rushed in by a dog; change of milking shed; outbreak of specific infective disease; and sudden shortage of drinking water.

Question No. 4.—*Indicate your ideas of the respective advantages of the following fodders in the feeding of dairy cows, and state your reasons:—(a) Wheat bran; (b) oaten straw; (c) mangels; (d) green maize (three months' growth).*

In feeding dairy cows certain principles must always be borne in mind—1st, that a certain amount of dry material is necessary; 2nd, that a certain amount of nitrogenous, proteid, or albumenous material is necessary; 3rd, a certain amount of carbohydrates; 4th, a certain amount of hydrocarbons or fats; 5th, a certain amount of salts and water. In the substances under notice wheat bran is advantageous on account of the proteid contained, its nitrogenous ratio being high. Oaten straw supplies a small amount of the proximate constituents, but largely represents the dry matter. Mangels consist largely of water, the solid material of them representing the carbohydrates mainly. Green maize is a fairly representative fodder of all the constituents, but by itself has too much water.

The fats are present to a variable degree in all the fodders, and are capable of being formed in the body from the non-nitrogenous portion

of the proteids, and to a certain extent from carbohydrates, though how this change is brought about is not clearly demonstrated.

A mixture, then, of the above-named foods is seen to be advantageous. Separately, green maize stands first; wheat bran, plus water and chaff, second; oat straw, third; and mangels by themselves would be of little value.

(*Examiners' Note.*—This answer is much too general. By that we mean that a farmer unacquainted with the subject could not extract much information out of the answer that would be of practical use to him in the compounding of a ration from the feed stuffs named.)

Question No. 5.—*How would you distinguish between a tuberculous udder and an inflamed one?*

Inflammation of the udder is primarily distinguished from tubercle by the fact that the former is sudden in appearance compared to tubercle.

An inflamed udder is swollen, tender to touch or absolutely painful, depending upon the extent of the affection; the swelling is uniform in the quarter affected or in the whole gland; secretion of milk is arrested, and a fluid of a clear nature, resembling whey, along with coagulated flakes resembling curd, may be obtained from the teats; or, depending upon the severity of the case, a purulent discharge may be present. In fact, any degree, from serous exudate to fœtid pus, may be found.

In tuberculosis the onset is never sudden. The gland may become swollen, but the swelling is irregular, hard, knotty, painless, irregularly situated in regard to quarter or gland, according to the number of foci. The secretion of milk, unfortunately, is not affected, except in advanced cases. When invasion of the gland is advanced and various centres are breaking down, then the milk may be tinged with blood, and be thick from escaping pus and disintegrated gland substance.

Question No. 6.—*Write what you know about contagious abortion in cattle, and briefly detail the measures necessary to prevent its spread.*

Contagious abortion in cattle is a specific infective disease, due to a bacillus. It is of a fixed nature, remaining on a farm for some time, and may be introduced by bringing diseased animals into a herd or by attendants.

It consists of a specific catarrh of the mucous membrane of the womb, infection usually taking place through the vagina. The period of incubation varies from one to ten weeks, or longer, and the first visible sign of trouble is the appearance of a discharge from the vagina. Within three days abortion usually takes place, and is brought about by the appearance of a serous exudate between the walls of the uterus and the fœtal membranes. A discharge continues after this, and may continue for a considerable period and produce great weakness.

To prevent the spread of the disease the fœtus and membranes must be burnt, then the parts of the cow which have been in contact, tail, hips, openings, mammary gland, or the whole body if necessary, must be washed in some antiseptic, as carbolic acid, 1 in 40; perchloride of mercury, 1 in 1,000; lysol, creolin, &c. The vagina and uterus must be washed out with the same substances in weaker strength at first, say mercury, 1 in 2,000, after calving, which may be increased in strength to 1 in 1,200 or 1,500.

All woodwork should be scraped, then washed with water as hot as can be managed, in which washing soda is dissolved, and then painted all

over with limewash containing carbolic acid, 1 lb. to 4 or 5 gallons, or simply painted with carbolic lotion or perchloride of mercury. This latter must not follow the soda wash, as it would be valueless.

The soil in contact with membranes, fœtus, or discharge should be burnt over, then dressed with quicklime and turned over.

The bull must have the sheath and penis syringed out with the perchloride lotion.

(*Examiners' Note.*—The candidate failed to mention the necessity for isolation of aborted cows, or injection treatment of all the cows in the herd whether aborted or not, and whether in calf or not, and for the non-use, for a period of three months, of the bull that has served aborted cows.)

Question No. 7.—*Describe, in detail, the methods you would adopt, and the agents you would use, to cleanse a milk-room that has become sour.*

To cleanse a milk-room that has become sour, every part of it—walls, floor, ceiling, doors, and windows, and all utensils in it—must be scrubbed out with a solution of washing soda in boiling water, washed all over with a solution of formalin in water, and afterwards limewashed. In case of a large building, the antiseptic or limewash may be applied by means of a spray pump, and a plentiful supply of fresh air and sunlight admitted.

Question No. 8.—*What steps would you take to locate the cause of a fault in butter, if deputed to visit a butter factory:*

To locate a fault in butter, the first step is to commence at the source of the butter—that is, the cow. A preliminary examination of the factory may be made, but by carefully inquiring into the method of treatment and management of the cow, cow-shed, milk-room, and all appliances on the farm, the method of carriage to the factory, and then carefully tracing the product through its various stages, examining all utensils, noting all temperatures, the degree of acidity present in cream, the method of handling, packing, and storing, the ventilation, drainage, and the water supply, the condition of all outbuildings, &c., the fault, of whatever nature, can be located.

(*Examiners' Note.*—Fuller details should have been given in regard to the method of overhauling the factory.)

Successful Candidates.

The following are the successful candidates:—

Baker, G. H.	Hamilton, R.	McKenzie, G.
Besley, A.	Harmer, G.	Reeves, S. A.
Bethune, A. D.	Harrison, C. K.	Robertson, W. A. N.
Burrage, T. A.	Holt, H.	Ross, A. J.
Christensen, D. N.	Molan, P. J.	Ryland, E.
Comans, M.	Morris, E. G.	Sherlock, S.
Connor, J. M. B.	McFadzean, J. S.	Younger, W.
Gordon, G. S.		

Of the 22 successful candidates, 10 are dairy farmers, 5 factory managers, 3 veterinary surgeons, 1 an analyst, 1 a shire inspector, 1 an inspector of the Agricultural Department, and 1 a dairy hand. They range in age from 20 to 44, the average being about 35.

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THE BEET SUGAR INDUSTRY.

I.—INTRODUCTION.

Hon. Allan McLean, M.P.

In my opinion, the failure of our first attempt to establish the beet sugar industry at Maffra was due principally to two causes. First, an

THINNING BEET AT MAFFRA.

insufficient supply of the raw material to work up; and, second, the inability of our experts to extract the usual percentage of the sugar contained in the roots, as proved by analysis.

Taking the last of these causes first, I may mention that the 9,000 tons of beet roots supplied to the factory during the first season were

shown by analysis to contain upwards of 14 per cent. sugar contents. From such roots we should have got at least from 9 to 10 per cent. of white granulated sugar. Speaking from memory, however, I think we only got about 5½ per cent. ; and, as the cost of extraction would be the same in each case, this enormous shortage would in itself make all the difference between success and failure.

The German experts attributed their inability to extract the proper percentage of sugar to the presence of an unusual proportion of invert sugar in the roots—that is, sugar that will not crystallize. They considered this was due to the beets having been grown on virgin soil, and said it would disappear when the land was cultivated for a year or two.

In my opinion, it was due chiefly to defective cultivation, such as the absence of autumn ploughing, winter fallowing, artificial fertilizers, and general laxity in working the soil, also to the fact that a large proportion of the roots were left on the field for two weeks, or more, after being topped, before delivery at the factory. When the top is cut off, the root begins to bleed, and, if left too long, this is liable to produce fermentation, which retards crystallization. It should not be difficult to test this matter by cultivating a few plots properly, and treating the roots within a reasonable time of being topped.

In order to secure a sufficient supply of beets to justify the reopening of the factory, it would, I believe, be necessary to get 500 or 600 growers, as each should only be asked to cultivate a few acres, which he could attend to properly by utilizing the labour of his own family. These plots should be grown in rotation with other crops, and would prove a valuable adjunct to dairying, as the by-products are an excellent milk-producing food for cows. The land should be ploughed about the end of autumn, allowed to lie in fallow during the winter, ploughed and worked into a fine tilth in the early spring. Before sowing the seed, proper fertilizers should be used, and weeding, thinning, and scarifying attended to.

I would suggest that during the first five years the Government should make such railway concessions as would enable farmers to grow all along the line from Bairnsdale to Warragul, also on the line *viâ* Sale, and to Briagolong.

If it can be proved that the industry will pay, and that beets can be profitably produced, in rotation with other crops, and as a valuable adjunct to dairying, fattening stock, &c., I have no doubt but a sufficient supply can be obtained, in a few years, within easy distance of the factory. I need hardly say that, if the Maffra factory succeeds, it will not be long before private enterprise will establish similar factories in other parts of the State.

II.—SOME OF THE PROBLEMS ASSOCIATED WITH THE REVIVAL OF THE INDUSTRY.

F. E. Lee, Agricultural Superintendent.

As public attention has recently been drawn to the prospects of reviving the beet sugar industry at Maffra, some details in connexion with the agricultural and associated problems involved will be of general interest. Until comparatively recently there has prevailed such misconception of the history of the Maffra venture that the mere mention of the word "beet" was sufficient to excite the scorn and ridicule of the casual observer.

After an interval of seven years, many of the objections raised and prejudices held by land-holders in North Gippsland have passed away, and it is now satisfactory to find that a genuine interest is being manifested in the discussion of the liberal proposals for reopening the factory. The recent visit of the Minister for Agriculture (Hon. George Swinburne, M.L.A.) to Maffra elicited from the large attendance of farmers who met him on that occasion the pleasing statement that they had sufficient faith in the resources of their district to again make an attempt to establish the industry.

The nebulous theories and practical suggestions offered from time to time since the factory closed down have now been crystallized by the Minister into concrete proposals. These proposals are being explained

BEET ELEVATING WHEEL AND WASHING TROUGH.

to meetings of farmers and others interested by the writer of this article, and the prospects of a sufficient area of land being guaranteed to start the factory are, at the time of writing, by no means bad.

SOME DETAILS OF THE BUILDING AND PLANT AT MAFFRA.

For the benefit of those readers who may be unacquainted with the capacity and equipment of the Maffra Beet Sugar Factory, a few details of the building and plant are given. The factory premises, situated in a compact block of 30 acres, are within 200 yards of the Maffra railway station, and are connected therewith by two lines, with switches, one for unloading beets at the receiving bins, and the other for the despatch of manufactured sugar. A railway weighbridge facilitates the weighing of beets arriving by rail. The factory building is of bold design, and was

built with sufficient room for future expansion. The complete plant—comprising washing, elevating, slicing, diffusion, purification, evaporation, sulphitation, boiling, and centrifugal machines—was supplied by the Brunswick Machinery Company (Germany), at a cost of £33,149. The capacity of the plant is guaranteed to 350 tons per day, but the plant can, on emergency, treat over 400 tons of beet in 24 hours. So far as may be gathered from the reports of professional engineers, the plant is in every way capable of performing the work put upon it, and little of the past failure can be ascribed to the working of the plant or the quality of the sugar produced. It might be mentioned that the selling price of the Maffra beet sugar on the Melbourne market was £22 per ton, a sufficient guarantee that the quality was all that could be desired.

VIEW SHOWING DIFFUSION BATTERY ON RIGHT, JUICE CLARIFICATION TANKS ON LEFT.

The water supply necessary for the working of the factory was drawn from the McAlister River hard by. Firewood and limestone were procured locally, the latter coming by rail from Dutson. Adequate provision is made for the disposal of the "pulp," as the by-product is called after the sugar is extracted, and railway trucks or drays may be filled with little or no delay.

The Campaigns of 1898 and 1899.

The factory began operations in April, 1898, and it was not long before it was found that the vehicles possessed by the local growers were inadequate to furnish the daily tonnage of beet demanded. The delays caused to the factory management, and the mounting up of expenses, may be passed over with the remark that these matters were unavoidable at the

time, because unforeseen; but they were sufficient to impress the directorate that the transport of the roots was a matter that urgently demanded attention in the future. The amount of clean beets delivered during the first campaign was 8,758 tons, and for the second campaign 6,317 tons. These quantities by no means represent the total amount of beet grown in the Maffra district. A considerable proportion of the total area grown—equal, approximately, to 20 per cent.—was never harvested, or, if harvested, the beets were not delivered at the factory, on account of the low price ruling at the latter end of the harvesting campaigns. Payment for beets was made on a sliding scale, according to the percentage of sugar present. In addition to the other pioneer difficulties encountered by the beet growers, a heavy fall of rain occurred in the autumn, and caused a serious deterioration of the sugar content of the beets, by producing an abundant growth of new leaves. Later experience has shown that it is

FILTER PRESS FOR CLARIFIED JUICE.

a mistake to continue the harvest immediately after a heavy fall of rain, because, given a week or two, the beets will nearly, if not wholly, regain their sugar content, while the weight of the crop is materially improved. It is only right to point out that early autumn rains may always occur in the Maffra district, but the weather records for the past 25 years show that these early rains are invariably followed by periods of dry weather. With an early harvest, a great proportion of the beet crop would not be subjected to deterioration by rains, while the remainder, if the sugar content is reduced, may be safely left to recover itself, with advantage both to the grower and the manufacturer.

Quality of the Beets.

To account for past failures, the statement has been made that the Maffra district was incapable of producing beets of a sufficiently high

sugar content to permit of their being profitably manufactured into sugar. A glance at the figures below, which are taken from the factory books, and are the qualities on which beet suppliers were actually paid, do not substantiate this opinion:—

Tons of Beets delivered between 12 and 14 per cent. sugar.		Tons of Beets delivered between 14 and 16 per cent. sugar.		Tons of Beets delivered between 16 and 18 per cent. sugar.	
1898.	1899.	1898.	1899.	1898.	1899.
5,443	4,029	2,907	1,719	408	569

QUADRUPLE SET OF EVAPORATORS AND MEASURING TANK.

When it is taken into consideration that heavy falls of rain occurred during the harvesting of each season, and harvesting still continued, it is only reasonable to expect that with earlier harvesting a larger proportion of the crop will be over than under 14 per cent. sugar.

DELIVERIES OF BEETS.

The often unjust criticisms that have been levelled at the beet industry have invariably ascribed portion, if not all, of the failure in the past to mismanagement in the factory. That this was hardly the case is clearly shown by a scrutiny of the average daily deliveries of beets at the factory during the first and second seasons.

It will be remembered that the capacity of the factory is 350 tons per day of 24 hours. Beet deliveries take place only in the day time, so

that the daily deliveries should cover both day and night work. The factory management was severely hampered from the very outset by the fact that the number of farmers growing beet was only small. In addition, the Beet Company itself grew 300 acres in 1898, and 559 acres in 1899; the Cultivation Company (a local syndicate of business people) provided 270 acres, and a syndicate formed among the directors of the Company grew 100 acres. Three-fifths of the total supply came from the three large syndicates. Absence of suitable labour—or, in fact, labour of any kind whatever—was wholly responsible for the smallness of the amount delivered per day. The farmers for the most part depended on their own labour and vehicles, and

VACUUM PANS FOR BOILING SUGAR.

as a consequence were not able to supply more than a fraction of the daily amount.

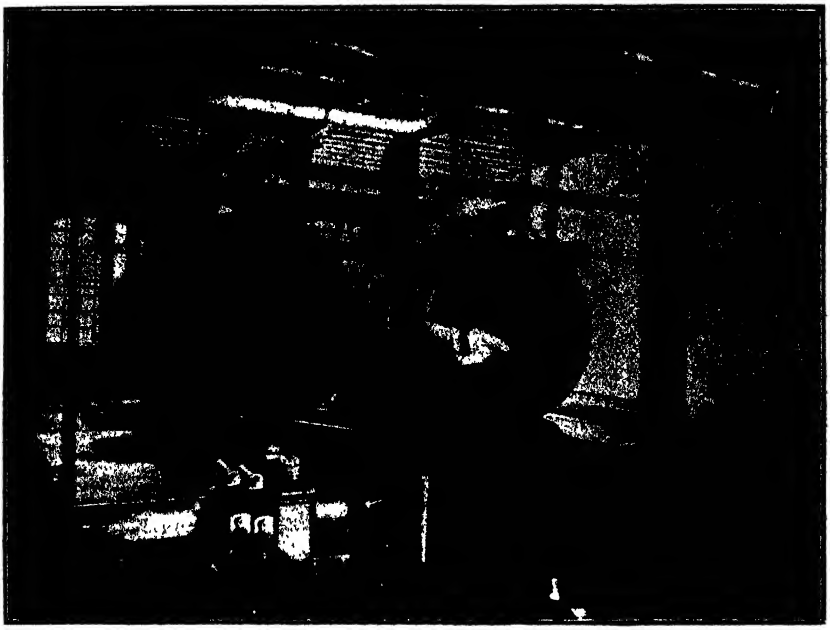
Daily tonnage of beets delivered.		Maximum amount delivered in one day.		Minimum amount delivered in one day.	
1898.	1899.	1898.	1899.	1898.	1899.
162	130	261	208	30	13

These figures are eloquent enough in themselves, and show convincingly that one of the primary reasons of failure was that the daily delivery of beet was never more than sufficient to give a half supply. Workmen cannot be put off from one hour to another, nor can steam be allowed to go down in a large concern like the Maffra factory, so that it is not surprising the

cost of manufacturing the beets into sugar was abnormally high. All the causes mentioned are remediable, and, in point of fact, it is only on the understanding that such leakages could be stopped that any attempt could be made to reopen the factory profitably.

SOME CONTRIBUTING CAUSES OF FAILURE.

So far as the previous history of beet-growing is concerned, the principal causes of failure must be looked for outside the factory. From a beet-grower's point of view, the sole concern he has is whether it will pay him to grow beet or not. The experience of the past has not been of the most profitable order, but there is much to be said for the often abused beet-grower.



SUGAR GRANULATORS AND DRIERS.

In the first place, individual growers were asked to undertake too large areas. The small number of suppliers made it impossible, as already shown, to maintain even a half supply of beets. The preparation of the land was, without exaggerating, in the majority of cases abominable. Grass land ploughed in the spring, in North Gippsland, is unfit for most crops, and particularly so for beets. At that period there is usually windy weather, and the land is denuded of moisture before the seed is sown. Some of the growers were altogether unprovided with the ordinary farm equipment of implements, and 40 per cent. of them had no vehicle for transporting beet, other than a single-horse dray or the light spring cart ordinarily used for conveying milk to the butter factory. Late sowing, absence of prompt thinning, and in many cases total neglect of after cultivation, were contributory causes to the ill-success of the first

season's crop. On the top of these drawbacks came a wet harvest, rendering carting not only difficult but in some cases impossible, on account of flooded roads. The uncertainty of securing further assistance from the Government in the second season again prevented an early winter cultivation of the land.

There was a distinct advance shown in the methods and promptness of the thinning during the second season, but an unprecedented spell of dry, windy weather throughout the spring and summer gave little hope of the crops making much weight per acre. The harvest of the second crop was begun a month earlier than in the previous year, and resulted, as may be seen, in a better proportion of beets over 14 per cent. sugar. I am satisfied that when the beet crop is normally grown, as would be the case

CENTRIFUGALS FOR EXTRACTING SUGAR.

with a winter preparation of the land, the dangers to be feared from second growth taking place at harvest time are considerably lessened. By adopting the remedy of an early harvest the management of the beet factory would have the bulk of the beets out of the ground before the end of April.

Is Beet-growing Profitable?

Under the conditions prevailing in the past, the answer to the above question can only be in the negative. It will be admitted by all who have had previous experience that the beet crop had little chance of success, considering the paucity of attention given to it. Other crops, such as cereals and maize, failed the same years as the beet, on account of dry weather.

What improvements, then, can be looked for to insure a greater measure of success in the future? First and foremost, the preparation of the land at the proper moment, viz., the months of April, May, or June at the

latest; a thorough surface cultivation in the middle of August, to get rid of millions of germinating weed seeds; earlier sowing than has hitherto prevailed.

I am prepared to say that beet can be planted in the early part of August, with no danger whatever from frost. By planting portion of the area at a time with, say, a week or ten days' interval, the thinning is easily handled, and the beet crop does not call for the whole attention of the grower, to the exclusion of his other farm or dairy work. In this one matter lay a great deal of the non-success and delay of thinning in the past. A grower of 10 acres, by planting it all at once, had that amount on hand to thin without delay. By the time the last 3 or 4 acres were

SUGAR SIEVES AND BAGGING APPARATUS.

reached the plants had grown too large, were much more difficult to thin, and the plants left suffered more from shock than if thinned at the proper moment. Considerable improvement might also be effected in the class of drills used. Since the Maffra factory closed down American beet-growers have succeeded in obtaining a machine which will plant the seed in "pockets" at 6 or 8 inch spaces. This economizes seed, renders the thinning less tedious, and gives a more regular stand of beets. I have heard of a machine which, by cross-hoeing the rows at right angles, will effect the purpose of leaving the plants in small clumps, but I am inclined to believe that this machine would only do perfect work when the land was quite level, and the germination of the seed regular. Of the two methods of reducing the labour of thinning, I favour the use of the "pocket" drill, but at the same time appreciate the possibilities of the cross-hoeing system.

Prompt thinning is imperative if a healthy stand of beets is to be procured, and no other work should be given precedence of this by the careful beet-grower. After cultivation embraces all the operations of inter-tillage.

No one particular implement is better than another. Any of the single or multi-toothed implements now in use will be found suitable, provided they do not injure the plants in any way. Hoeing, either by hand or horse implement, plays a double part in the well-being of a crop. It keeps down weed growths, and, above all, it checks evaporation by the preservation of a loose mulch of surface soil. It is impossible to say how many hoeings may be necessary, but a safe plan is to horse-hoe the beet crop every ten or twelve days, until such time as the spread of the leaves makes further working impossible. It is a well-accepted axiom among Continental beet-growers that "the sugar is hoed into the beet," and no pains are spared to accomplish that object.

In order to ascertain if beet-growing is profitable or not, I have procured the following estimate of the expenses of growing an acre of beet from a prominent beet-grower in the Maffra district:

	£	s.	d.
Rent of land	£1	0	0
Winter ploughing	0	15	0
Harrowing three times, at 1s.	0	3	0
Rolling once	0	1	0
Cost of seed, 12 lbs., at 8d.	0	8	0
Cost of sowing	0	1	6
Thinning	1	5	0
Hoeing twice, at 6s.	0	12	0
Ploughing out	0	5	0
Topping 12 tons, at 2s. 6d.	1	10	0
Carting three miles by waggon	1	10	0
	£7	10	6

This estimate allows a fair rate of wages being paid to the grower, and allows him also to charge for the use of his own horses and implements. As a set-off against the above cost, the grower may expect the following moderate yield:—

	£	s.	d.
12 tons beet, at 16s. per ton	£9	12	0
6 ,, pulp, at 1s. ,, ,, ...	0	6	0
2 ,, leaves, at 1s. ,, ,, ...	0	2	0
	£10	0	0

This would leave a liberal margin of £2 10s. per acre net profit. The yield per acre reckoned upon is only moderate, and one which will be exceeded by those growers who give special attention to the beet crop.

Even if the profit per acre were reduced from £2 10s. to £1 10s. per acre, it would still show as good a return as hay growing, and I further believe that if the dairymen charged the same expenses of rent, labour, plant, &c., beet growing would still hold its own as a source of income. Nearly the whole of the above expenses could be earned by the farmer and his family.

COMPARISON OF VICTORIAN AND AMERICAN ESTIMATES FOR GROWING AN ACRE OF SUGAR BEET.

In order to ascertain the relative costs charged for the same operations by the Victorian beet grower and his American cousin, I extract the

following estimate from *The American Sugar Industry*, by Herbert Myrick, 1902, the most recent publication on the beet industry:—

	Victorian.		American.
Rent of land	£1 0 0	...	£0 16 0
Cost of preparation, including seed and cost of sowing	1 8 6	...	1 14 0
Cost of thinning	1 5 0	...	1 0 0
Keeping crop clean during growth	0 12 0	...	2 7 6
Cost of harvesting, including ploughing out and topping	1 15 0	...	1 8 0
Carting 12 tons 3 miles ...	1 10 0	...	1 13 2
	£7 10 6	...	£8 18 8

There does not appear, after all, to be a very great deal of difference between the two totals, but when the details are analyzed separately, the points of difference are remarkable:—

Rent of Land.—In this respect the American grower has a slight advantage.

Preparation of the Land.—In this matter the American spends 5s. 6d. per acre more than the Victorian. The cost of the operations is much the same, therefore the difference can only be in the number and variety of the operations.

Cost of Thinning.—In this item, despite the frequently-expressed contrary opinion, the Victorian grower has little to learn from the American, save, perhaps, the promptness with which the work is performed.

After Cultivation.—The after-cultivation is the operation in beet growing that has more influence than any other on the ultimate yield of the crop. Note the difference in the amounts spent by the beet growers of Victoria and America. The former spends a beggarly 12s. per acre in two horse hoeings; the latter a sum of £2 7s. 6d., covering two hoeings by hand, one preceding and one following the thinning, besides six horse hoeings.

I am convinced that herein lies a great deal of the non-success in beet growing as carried out by the Victorian farmer. While the beet crop is young it wants constant attention. The young plant grows very rapidly in its early stages, and makes heavy demands on the moisture supply of the soil. If this moisture is not conserved by hoeing to arrest evaporation, the young plant soon receives a check in growth, and the hot weather of the summer months of December, January, and February effectually prevents the plant making its maximum growth.

I need not draw especial attention to the presence of weeds in Gippsland soils; they are prevalent enough everywhere, but I may be allowed to remark that there are few cultivated plants that respond better to cultivation than do beets, and unless a radical improvement is introduced into future beet growing ventures, there are bound to be similar stories told of ill-success.

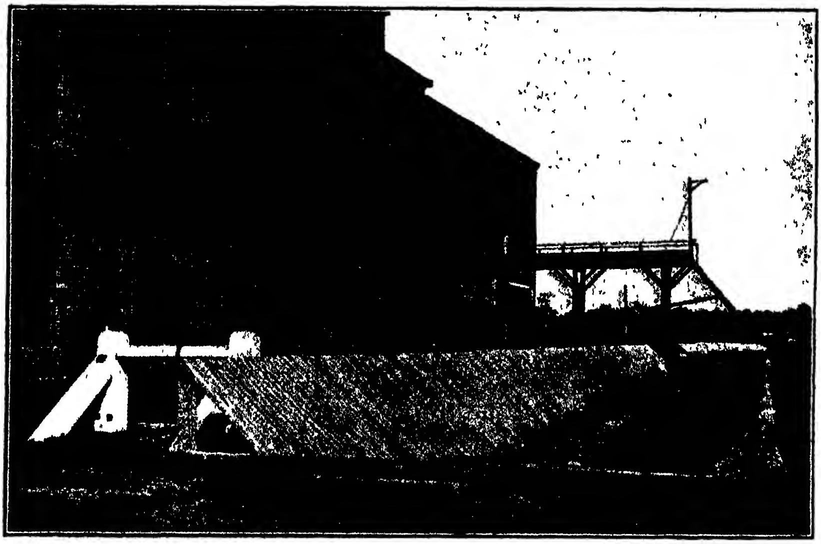
Carting.—The distance from the field to factory or nearest railway station must always regulate the cost of this item for beet as for all other

farm produce. I have consistently urged the importance of this matter from the factory point of view, and the details already given of the daily deliveries of beet are sufficient to justify the organization of a transport system by the management.

A factory without an adequate supply of raw material is helpless, and if beets are to be drawn from a wide radius by rail and road, it is imperative that proper arrangements be made to insure an improvement in this direction. There would be little difficulty in organizing the routes for a number of traction engines and waggons to take delivery of beets along the roadside; if adopted, this arrangement would relieve the grower of a great responsibility, and would permit of continuous work for the factory plant.

THE GOVERNMENT PROPOSALS.

The present situation of the beet industry stands as follows:—The Government possess the factory building, plant, and premises. The machinery has not deteriorated since the late Company ceased operations, having been well cared for in the meantime. While the plant is inoperative,



VIEW SHOWING BEET BIN IN FOREGROUND AND PULP DISCHARGE IN REAR.

the large sum of £62,000 invested in the industry by the Government is lying idle, with no prospect whatever of the money coming back to the Crown. As a result of personal inquiry into the reasons of failure, the Minister for Agriculture has been authorized by the Cabinet to make the following proposals to farmers and land-holders interested in the establishment of the beet sugar industry on a sound basis:—

(*a*) Farmers to undertake to grow beet for a term of five years.

(*b*) Areas of from 2 to 10 acres to be prepared, planted, and grown under the supervision of officers of the Department of Agriculture.

(*c*) The Department to supply seed at cost price.

(*d*) For the first season all topped, clean beet shall be paid for at a uniform price of 16s. per ton, delivered at the factory, if the

sugar content amounts to 12 per cent. or upwards. A reduction in price of 1s. per ton shall be made for each 1 per cent. reduction in the sugar percentage below 12.

(*e*) In order to encourage growers at a distance from Maffra, the Department will make a rebate on the railway freight when this amounts to more than 2s. per ton. The maximum rebate will be 2s. per ton. Thus, if the freight is 3s. per ton, the Department will pay 1s. and the grower 2s. If it amounts to 4s. or over, the Department will pay the maximum of 2s.

(*f*) Until proper pulp-drying machinery has been erected at the factory, all suppliers will be entitled to the pulp produced from their beets free of cost, delivery to be taken at the factory. On erection of such machinery, suppliers will be charged with the net cost of drying.

(*g*) After paying 10 per cent. on capital to cover interest and depreciation of plant, all profits will be divided *pro rata* as a bonus among the growers. The cost of reopening the factory will be added to the capital account.

(*h*) The Department will not go on with the scheme unless 3,000 acres are guaranteed.

(*i*) The bonus will not be paid to any grower until the following season's crop has been planted and thinned.

(*j*) After the first season, payment for beet and division of the bonus will be arranged solely on the basis of the percentage of available sugar in the beets.

EXPLANATION OF THE PROPOSALS.

The writer of this article has been instructed by the Minister to personally canvass the districts between Warragul and Bairnsdale, and explain to meetings of farmers and others interested the details of the above proposals. It may be here said that a guarantee to grow beets for five years may reasonably be expected if the Government is to undertake the responsibility and expense of reopening the factory. The areas asked for are small, and intending beet-growers are unlikely to undertake more than they are capable of carrying out. It is recognised that to make the industry a success, there must be a large number of small growers. The more persons engaged in beet-growing, the less chance there is of a break-down in the supply, and the more likelihood of the area being extended, should the venture prove a success.

The price offered, viz., 16s. per ton for 12 per cent. beet, is a most liberal one, and marks an advance of 33⅓ per cent. on previous rates paid for beets of a similar quality. Beets grown under capable supervision are unlikely to be below this content, and, should heavy falls of rain deteriorate the sugar content of the roots, the management can arrange for roots being left in the ground until they recover.

The rebate on railway freights will permit of beet being grown at considerable distances from Maffra, and will thus bring in persons in other localities that were previously prohibited from profitably growing beet on account of the high freight charges. Where pulp is required to be returned to growers by rail, the same rebate will be allowed in freight as on beets. The ultimate drying of the pulp will materially reduce the railway freight. It will be noted that only beet-growers will receive pulp free of charge.

The deduction of 10 per cent. to cover interest, depreciation of plant, &c., will be made on the original amount invested by the Government, plus the cost of re-opening the factory; but, as a set-off against this, the Government will be entitled to claim a bonus of £2 a ton on white-grown sugar, under the Commonwealth Sugar Act. This bonus for white-grown sugar will nearly, if not entirely, cover the deduction for interest, depreciation, &c.

The division of the net profits as a bonus to beet-growers should stimulate those interested, because it will mean an additional price for the beet. Calculating on an acreage of 3,000 acres, with an average yield of 10 tons per acre, the factory would work up 30,000 tons of beet. Assuming that it would require 12 tons of beet to make one ton of granulated sugar, there would be 2,500 tons of sugar. Valuing the sugar at £20 per ton, the present market price, the gross return from the factory would be £50,000;

TYPES OF BEET, PERFECT IN SHAPE AND WEIGHT AND PROPERLY TOPPED.

and, with the Federal bonus of £2 per ton on sugar, equal to £5,000, the gross return would be £55,000. Allowing the enormous sum of £50,000 for cost of beets, manufacture into sugar, and depreciation of plant, a net profit of £5,000 divided into 30,000 tons of beet would mean a bonus of 3s. 4d. a ton. If beet were worth 19s. 4d. per ton, it would be more profitable than most other crops, and many other industries.

The Department requires, before entering into the question, a guarantee of 3,000 acres of beet. That this amount may entail some difficulty in procuring is not denied; but, when once the details of the question are understood, there is sufficient enterprise in Gippsland farmers to guarantee more than this area.

THE PULP QUESTION.

One of the matters of paramount importance to the dairy farmer is the supply of succulent fodder for his stock. The production of this

fodder is, as yet, not as assured, or as regular, as it might be. The refuse pulp from a beet factory has very great advantages for the feeding of dairy cows, as is evident from the following analyses:—

—	Beet Pulp	Clover Silage.	Maize Silage.
Water	90.0	72.0	70.6
Ash	.3	2.6	2.6
Protein...	1.5	4.2	2.7
Fat	.4	1.2	.7
Sugar and Starch ...	4.7	11.6	13.7
Fibre	3.1	8.4	9.7

From these figures it will be seen that fresh beet pulp has nearly one-half the value of maize silage. If the surplus water is dried out, the beet pulp

BEET CROP BEING HARVESTED.

would have about the same value for feeding purposes. One great advantage beet pulp has over ensilage is that it does not require any expensive silo for storage purposes. Beet pulp, if desired to be used to the best advantage, can be stacked and covered with a layer of straw and earth, in a similar way as potatoes are pitted.

CONCLUSION.

In conclusion, a few words might be said of the meteoric rise of the beet industry in the United States, after many years of pioneering non-success. Six years ago there were over 50 factories in operation, with an invested capital of 34,000,000 dollars. The money paid to farmers was 15,200,000 dollars a year, equal to £3,040,000. In Germany, eight years ago, there were over 400 factories in operation, using beets from 1,080,256

acres of land. The average yield per acre in Germany was 12.2 tons, and the average quality of the beet 12.7 per cent.

The area under beets on the Continent up to the year 1896 was 37,000,000 acres, or an area equal to nearly one-half that of the State of Victoria. In the same year the world's production of sugar was: Beet, 4,773,000 tons; cane, 2,432,000 tons.

A thoughtful study of these statistics should be sufficient to impress even the most prejudiced mind that the potentialities of beet-growing in Victoria are almost unlimited. The initial failure in Victoria was discouraging, but there is no logical reason why the Victorian beet sugar industry should not rise, Phœnix-like, from the ashes of its own dead past.

CLOSER SETTLEMENT STUDIES.

DAIRYING AT SWAN HILL.

P. J. Carroll, Dairy Supervisor.

Unlike the farmers in the rich Western District who started on small areas, the farmers of Swan Hill district commenced on large holdings, and have yet to learn much of the secret of getting the maximum return out of a limited area, or, in other words, the adoption of a system of intense culture. It is disagreeable to say it, but one cannot help feeling that until recent years farming in this district was carried on by slipshod methods. Whatever it may have been in the past, however, one cannot help becoming imbued with the change that is now taking place. The progress and enthusiasm shown by many of the settlers bid fair to bring the state of productiveness of this district up to the position which it should have attained years ago, and to which it was originally intended owing to its great fertility.

The land is a dark, grey loam, resting on heavy clay, and forming what are termed the "flats," or "Murray Flats." The chief feature of this land generally is its richness, growing prolifically almost any crop sown on it, provided sufficient moisture is made available. The great difficulty, however, is the low rainfall—about 12 inches per annum—which renders artificial watering necessary. This is now being done on a small scale, and almost every farm has its channels and its checks, and the rainfall is thereby supplemented on at least a portion of the holding.

The land is found to be admirably adapted for irrigation on account of its splendid drainage, and the crops and pastures immediately respond to the treatment. Much has yet to be learnt in this direction, so as not to detrimentally affect the physical and mechanical condition of the soil by the injudicious use of water. There is less fear of such a result in the district under notice, as the land seems to be naturally adapted to irrigation. When discussing the subject of irrigation generally with a resident of the "flats," I ventured to say that irrigation would yet solve the closer settlement question, even in districts situated long distances from the main rivers; but he shook his head, and said that "Nature in her wisdom made land that was destined to be flooded suitable for that condition until the hand of man altered it; and consequently when the same state was brought about by artificial means on land that was not subject to periodical flooding, it was liable to have an injurious effect; but, on the other hand, land where annual floods were the rule would not be injured."

I have not sufficient experience to say that this statement is perfectly true, but it certainly appears to be at least worthy of some consideration.

There is no question but that land in this district periodically under flood is not injured either physically or mechanically by the yearly flooding, and such land must lend itself successfully to artificial watering to supplement the rainfall.

Without unduly criticising the methods of the farmers occupying this land, it may safely be said that the best use has not been made of the opportunities. Of late years, however, cultivation of the cereal crops only has given way to the more regular and reliable operation of dairying. Whilst many of the farmers have not yet grasped the idea that beef cows do not usually make dairy cows, and the importance of culling out the wasters and filling their places with heifers from their best dairy cows (as determined by the keeping of records of milk yield and testing for butter fat), some at least are adopting these methods.

The returns which I am about to give were taken from factory records of the dairymen themselves; in every case precautions were taken to verify same, and from my knowledge of the district and the men from whom the figures were obtained there is no reason to doubt their accuracy. To the southern farmer some of the returns may not seem exceptional, but to one knowing the circumstances under which they were obtained they are very satisfactory indeed.

I would like to mention that, although the areas in many cases seem large in proportion to the number of cows kept, it must be understood that the land under natural conditions will give only a fraction of its maximum yield, either of crop or pasture. Only a small part of each farm is fully developed. The milking herds, and, in fact, most of the other stock are confined to the lucerne patches and sorghum plots for their food. I have endeavoured to obtain the area on each farm under these two magnificent fodders:—

Farm No. 1.—Area, 160 Acres.

Pasture (natural grass) ...	75 acres	19	Dairy Cows.
Pasture (lucerne) ...	30 acres	140	Ewes and Lambs.
Cultivation (wheat) ...	50 acres	70	Lambs (sold).
Orchard and Garden ...	5 acres	10	Calves.
		7	Horses.
		30	Pigs.

Whilst no definite record was kept of the dairy herd, I was assured that the total return for cream for the season covering eight months was over £60. The calves reared are valued at the modest sum of 30s. each, and would represent £15; the whole of the pigs were reared on the place (no sales were effected during the season) and are now worth an average of 15s. each, or a total of £22 10s. The progeny of 100 ewes, viz., 110 lambs, some of which were sold at 12s. per head, equals £66, and to this must be added £28 net for the wool clip. The enhanced value of the ewes, which are now all fit for the butcher, should be estimated at least at another £20.

The area under crops was not looking promising, and was consequently cut for hay, of which there were 100 tons; this may be roughly valued at £2 a ton, representing £200 standing. It will, therefore, be seen that, whilst any of the different branches above-mentioned did not give abnormal yields, the total sum received was £441 10s. The labour of working this

farm, according to its area, would not require more than the services of a man and a boy. The cost of irrigation for crops is 2s. per acre if pumped, and 1s. if by gravitation; for lucerne land a similar charge is made, and for pasture (grass), 1s. and 6d. respectively. In the worst year three waterings are the most that are required, and usually the first two are by gravitation. As previously mentioned, the grass land is rarely watered, so the cost of irrigation on this farm would be confined to the cultivation and lucerne, costing £16 for water, and about £2 for labour in irrigating, leaving a net return of £393 10s. for the year's operations.

No account is kept of the return from the orchard or poultry, although both are said to more than pay their way. It will be noticed that seven horses are kept, and fed on this farm, from which no return is claimed. Three horses would be sufficient for the work of the farm, but the keeping of a number of idle horses seems to be the failing of the average northern farmer.

FARM NO. 2.

This is a farm of a much larger area, and consists of 600 acres. Two hundred acres are under lucerne, and 80 acres under barley, the balance being natural grass. The number of stock is:—Dairy cows, 65; calves, 60, dry cattle, 100; sheep, 600; pigs, 70. I could not obtain any details in this case, but was informed that for the months of October and November the cream cheques amounted to £20 per week, and at present are about £14 per week. My attention was drawn to two beautiful paddocks of lucerne, consisting of 30 acres, on which I was told 30 head of cows depastured for six months, and the only cost was one watering at 2s. per acre.

The annual return from the herd of dairy cows was estimated at £10 per head. If the weekly yields are taken into consideration, it will be seen for the month of October the cheques were £20 per week, which would represent a monthly return of £1 7s. per cow. Owing to the drought-resisting qualities of lucerne, and the capacity of the land to grow any kind of summer crops prolifically with the aid of irrigation, this district will keep the cows in a high state of productivity for a longer period than most of the southern districts.

FARM NO. 3.

No. 3 farm is situated on the Murray, about 6 miles from Swan Hill, and consists of 100 acres, the whole of which is under natural grasses. This farm is readily irrigated from the river up to November by gravitation, but last season only some 60 acres were irrigated once, at a cost of 6d. per acre.

The tenant commenced dairying, or at least the records were kept from the 1st August, 1905. The following statement shows the number of cows in milk for the different months, August, 1905, to February, 1906, and the amount received for cream:—

					£	s.	d.
August	...	12 cows—586 lbs. butter		...	22	0	0
September	...	14 ,,	622 ,,	...	23	7	0
October	...	14 ,,	617 ,,	...	23	3	0
November	...	20 ,,	783 ,,	...	29	7	0
December	...	28 ,,	800 ,,	...	32	2	6
January	...	28 ,,	595 ,,	...	24	0	0
February	...	28 ,,	522 ,,	...	19	7	0

The total yield for cream alone amounts to £173 6s. 6d., and if the average number of cows is estimated, it will be found to be twenty, and the average return for each cow for the seven months under review would be £8 13s. 3d., truly a remarkable return from cows fed on natural pasture only. Whilst there were 28 cows on the farm, it would not be fair to debit the farm with that number until all were in profit, but after the first year this should be done. The above, however, demonstrates how prolifically the cows yield when in profit.

In addition to the return for cream, 27 calves, worth £40 10s., and 27 pigs, worth £1 per head, were reared, making a total return from 28 cows of £240 16s. 6d. for seven months. Assuming that the milk yield is but 7-12ths of the year's yield from the cows, another £123 16s. 1d. would be added, making a total of £297 2s. 7d. In one week in November, 239 lbs. of butter were produced, representing within a fraction of 12 lbs. per cow for the week.

As before mentioned, no artificial fodders were grown, but should a proportion of this farm be devoted to lucerne and sorghum-growing, the carrying capacity would be doubled, with the aid of irrigation. The cows are of mixed breeding, but are chiefly too beefy in appearance to be high-grade dairy cows.

FARM No. 4.

This farm consists of 320 acres, all under natural grasses, and has a frontage to the river Murray. Two hundred acres were irrigated by gravitation last November at a cost of 6d. per acre, the labour involved costing another 6d. per acre.

The total number of dairy cows on the farm is 27. Up till June, 1905, only eighteen were milked; six heifers were then purchased, two of them calving the same month, two in July, and two in August. Three more cows in profit were purchased in October.

The following are the monthly returns for cream sold during 1905:—

	No. of cows.	£	s.	d.		No. of cows.	£	s.	d.
January	18	14	9	5	August	22	21	12	8
February	18	13	9	10	September	24	32	3	8
March	18	12	2	8	October	27	31	8	9
April	18	13	12	6	November	27	27	0	0
May	18	7	4	10	December	27	34	6	6
June	18	6	18	3					
July	20	12	15	10	Total	...	£327	4	11

If the actual average of cows in milk in the above is estimated, it will be found to run out at 21 cows for the whole year, and the average yield from the cows would be close up to £11 per head. Although the average is 21 cows, it would not be fair, in this case also, to debit the herd with cows that were not on the farm during the whole of the year. As already stated, nine were added during the second half of 1905.

The cows milk for ten months each year, and even then great difficulty is experienced in drying them off. No special attention was given the cows on this farm; lucerne or sorghum is not grown, so the cows had to depend entirely on the natural pastures. The milking was done by the farmer, assisted by a boy and a girl; the latter was engaged to assist in housework.

The area of the farm may appear large for a return of £227 14s. 11d., but other stock were fattened at an estimated profit of £40. Twenty calves, valued at £30, were reared, bringing the total up to £297 14s. 11d. This, however, is only a fraction of the possible yield of land under a system of closer cultivation, and growing of lucerne and other green fodders, for which the district is so splendidly adapted. The owner assured me that if the land was under lucerne and properly attended to, one dairy cow could be carried for every two acres of pasture. This is not a high estimate of the carrying capacity of this class of land under proper treatment, and it is the opinion of many that if proper records could be obtained it would be found that in many instances one cow to the acre is carried.

GARDEN NOTES.

J. Cronin, Inspector Vegetation Diseases Acts.

The Bouvardia.

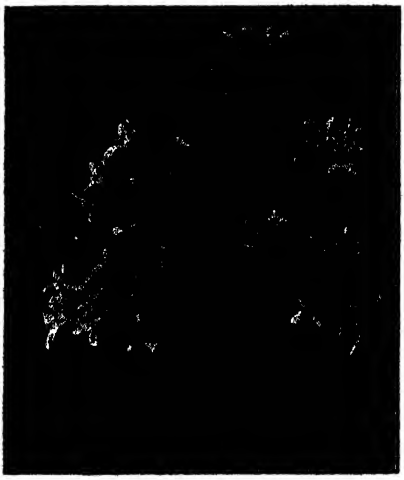
The bouvardia is a dwarf, shrubby, perennial plant specially suitable for planting in small gardens. The original species are natives of Mexico, and have been grown as green-house plants in England and Europe for more than a century, one species, *triphylla*—still to be found in our gardens—flowering for the first time in England in 1794. The types are rarely grown now, having been superseded by varieties raised by hybridists that are superior in every way. The flowers are larger, the habit of growth larger and sturdier, and the colours much more varied.

In Australia the bouvardia is practically a hardy plant, thriving well under the ordinary conditions that govern border cultivation. The plants are in some districts denuded of their foliage and the growths cut back by frost, but under fair conditions invariably break away into growth again in the following spring. For effect in the garden during autumn and early winter there are few shrubs more valuable than the bouvardia, the neat little bushes producing quantities of showy flowers for a long time. The flowers are valuable for table and other room decoration, the colours of the best varieties being bright and distinct; some varieties are very fragrant; and the whole class is specially valued by florists on account of the suitability of the blooms for bouquets and sprays for personal adornment. Bouvardias are propagated from cuttings of the young shoots taken from plants forced into early growth in hot-houses. They require bottom heat to insure any certainty of the cuttings rooting. Cuttings of the roots will also produce plants, and a gardener without conveniences such as hot-houses or hot-bed frames would be more successful in such mode of propagation. Plants can be purchased cheaply from nurserymen, and in the winter could be sent in safety by post to a long distance. Any fair garden soil will suit bouvardias, that of a rather retentive nature being most suitable. In very light sandy soils, some loam or clay should be added for these plants. They will eventually grow into bushes about 4 feet in height and 2 feet in diameter, except in the case of Humboldtii corymbiflora, which is of larger and looser growth. Where the plants are required specially for supplying cut flowers, they may be planted

in narrow beds and protected from frosts by a shading of hessian or similar material. In preparing soil for the reception of bouvardias only well-decayed manure should be used, the addition of a little bonedust and fairly deep working being advisable, as under fair conditions the plants may last and give good results for possibly twenty years. Early spring is the best time to plant; if late frosts are usually experienced, plant later or shelter against frost temporarily.

The plants should be pruned fairly closely each year. If unsightly, some of the frost-affected growths may be removed in winter, but it is not wise to cut back to living wood until spring. Thinning out growths is important, or the plants will become tall and crowded.

Insect enemies of the bouvardia are brown scale, aphis, and mealy bug. Spraying with a strong solution of soft-soap and tobacco is the safest and



SINGLE-FLOWERED VARIETIES.

DOUBLE-FLOWERED VARIETIES.

most effective means of combating these pests. Working soot into the soil around the plants will deter the mealy bug and stimuate the growth.

Varieties:—Single-flowered—White, "Humboldtii" and "Humboldtii corymbiflora" (large flowers, very fragrant), "Beauty of Brisbane" (one of the best), "Candidissima" and "White Bouquet"; scarlet, "President Cleveland," "Hogarthii," "Elegans," and "Dazzler"; pink, "Maiden's Blush," "Bockii," "Priory Beauty," "Countess of Hopetoun," and "Miss Ida Cheeseman"; pale yellow, "Flavescens." Double varieties—White, "Alfred Neuner"; pink, "President Garfield" and "Australian Beauty"; scarlet, "Hogarthii flora-plena" and "V. Lemoine"; and pale yellow, "Flavescens flora-plena."

Flower Garden.

Pruning, planting, manuring, and digging constitute the most important work during July. Pruning is undoubtedly one of the most important tasks connected with gardening. The main objects are to produce large, strong, symmetrical plants; to regulate the size according to area, and to promote growths that will flower freely in advantageous positions or produce certain effects. To promote vigorous growth, most plants should be

pruned in winter; to regulate the ensuing growths, the plants should be disbudded, pinched, and regulated during active growth. The most commonly noticeable faults are—too many shoots or branches are generally allowed to remain; the vigorous shoots are pruned too hard, *i.e.*, too much is cut off the shoot; and the weaker shoots are pruned too light, and often not at all. In every case room should be allowed for light and air to penetrate to all parts of the plants, and only an even-size type of shoots or branches allowed to remain. Strong, straight shoots should always be cut clean away if the plant is healthy, otherwise the unhealthy wood should be removed and the strong growths manipulated to make a new head. By thinning out and lightly pruning the growths on vigorous plants, the unsightly bare stems so frequently seen are avoided. Newly-planted roses and deciduous shrubs lifted from the ground should be pruned hard at time of planting.

Digging is a more important operation than is usually considered. It should be not only the turning down and covering of weeds for neatness sake, but a thorough, even working of the soil, even distribution of manures and soils to improve the general staple if possible, and to break any hard layers that may have been formed during summer by the shallower operation of hoeing, and which are likely to prevent access of air and water to all parts of the beds. In digging among plants, great care should be taken to avoid damaging the roots. Weeds growing near plants should be skimmed off and dug deeply into the beds outside the root radius. The operator should have a narrow trench in front to the full depth of the digging, into which manure, weeds, small prunings, &c., can be easily turned. An even, but not smooth, surface should be aimed at.

Carnations will require attention in staking, tying, and thinning. Where the plants are encircled with mesh wire, thinning only is necessary. The tree varieties develop many side-growths, all of which, if allowed to remain, would unduly crowd the plants and tend to the production of inferior blooms. Inside shoots should generally be removed when thinning. Cuttings made from such shoots, planted firmly in sandy soil, are likely to "strike," and will grow into good plants for next season. Soot, if worked into the soil around the plants, will greatly aid the flowering and assist in keeping the plants healthy and free from slugs, &c. Dahlia tubers may be lifted and stored in a dry shed during winter. If the ground is of a nature that holds moisture, it is safer to lift them now than in spring. The preparation of the beds for next season's planting can also be proceeded with. If available, new ground should be selected, but if not, new soil and manure should be well worked into the beds before dr weather begins.

Bulbs of various summer blooming Liliums should be planted. No manure should be permitted to touch the bulbs, or they are sure to rot. In gardens in the country districts where manure is scarce, fine clumps of Lilium auratum, and other kinds, are often to be seen blooming splendidly where weeds refuse to grow. Amaryllis, and an early batch of Gladiolus, may be planted.

Hardy annuals may be transplanted. If seedlings—where sown to remain till flowered—are growing too thickly, they should be thinned out, and may make useful patches of colour later, if room is available for their reception after the beds are dug.

Kitchen Garden.

Sowing seed of various vegetables, planting out from former sowings, and preparing ground for future crop is generally the routine work during the winter months. Asparagus, onions, &c., should be transplanted, and sets of early potatoes planted in early situations. Seeds of onions, peas, broad beans, cabbage, and other vegetables that will be required during the spring months may be sown.

Those who intend to raise tomato plants in heated beds should prepare the manure, &c., for the purpose. Fresh stable manure, with plenty of straw, is needed, and it must be watered, stacked to ferment, and turned at least twice to insure an even heat, without which it would be useless to attempt the raising of delicate plants. Dry, open, sunny positions should be selected for such beds, with some protection from cold winds.

THE ORCHARD.

James Lang, Harcourt.

In last month's number of the *Journal*, the best apples suitable for export were enumerated. The best varieties of pears for export are now furnished for the information of orchardists.

Winter Nelis has so far given the best results. It is generally landed in fairly good condition, and, being also a pear of the first quality, realizes a high price. Exception may be taken to this variety on account of it being a shy bearer in some districts, but this is due in a great measure to faulty pruning. The tree has a tendency to form too many fruit spurs, and so exhausts itself in blooming; but if the fruit spurs are well thinned out at pruning time, the result would be a more satisfactory setting of fruit. Josephine de Malines is also one of the best varieties, and when landed in good condition realizes a high price. Beurre d'Anjou is another good export pear, and so also are Beurre Clairgeau, and Bretonneau. Eyewood, generally called Broompark, from which it is quite distinct, is also suitable for export. Glou Morceau also carries well, and sometimes brings a high price. Vicar of Winkfield has been shipped in large quantities, and has been on the whole fairly successful. This is only a second-rate pear, as far as quality is concerned, but it is a regular and constant bearer.

The foregoing varieties have so far proved themselves to be the best export pears, but the conditions under which pears have been carried by the various shipping companies leave room for a good deal of improvement. Pears require to be carried at a much lower temperature than apples, as near as possible 35 degrees Fah. From reports to hand, the past season has been a disastrous one for pear shippers, consignments in most cases arriving in a rotten and absolutely worthless condition, owing to being carried at too high a temperature, or in some cases allowed to get frozen. A good trade could be done with pears if the carrying conditions were more reliable.

The fruits specified in the following lists are suitable for planting, either for market or for home consumption, and are arranged in their order of ripening.

JONATHAN.

Apples.—Williams' Favourite, Gravenstein, Emperor Alexander, Green Alfriston, Jonathan, Reinette de Canada, London Pippin, Esopus Spitzenberg, Munroe's Favourite, Cleopatra, Rome Beauty, Rymer, Stone Pippin, Rokewood.

Pears.—Williams' Bon Chretien, Doyenné, Boussoch, Gansel's Bergamot, Poire de Berriays, Beurre de Capiaumont, Beurre Hardy, Beurre Bosc, Marie Louise, Beurre d'Anjou, Eyewood, Winter Nelis, Josephine de Malines.

Plums.—Early Rivers, Early Orleans, Angelina Burdett, De Montfort, Diamond, Grand Duke, Washington, Yellow Magnum Bonum, Pond's Seedling, Coe's Golden Drop.

Apricots.—Oullin's Early Peach, Royal, Hemskirke, Mansfield Seedling, Moorpark, Dundonald.

Peaches.—Amsden's June, High's Early Canada, Alexander, Brigg's Red May, Hale's Early, Crimson George, Royal George, Elberta, Foster, Prince of Wales, Lady Palmerston, Salway.

Cherries.—Early Purple Guigue, Burgdoff's Seedling, Twyford Bigarreau, Early Lyons, Eagle's Seedling, Black Bigarreau, Bedford Prolific, Biggareau Napoleon, Florence, St. Margaret.

Figs.—White Genoa, Large Black Genoa.

Currants.—Black Naples, La Versaillaise (Red), Carter's Black Champion, Bertyns No 9.

Strawberries.—Edith, La Marguerite, Up-tut-mark, Trollope's Victoria.

Pruning should be taken in hand at once, and pushed on until completed.

DESCRIPTION OF APPLES.

James Lang, Harcourt.

Jonathan.

Fruit medium size, conical and regular in its outline, about $2\frac{1}{2}$ inches in diameter, and 3 inches high. Skin covered with bright red, becoming dark red when fully exposed to the sun, a brilliant and beautifully coloured apple. Flesh white, tender, and juicy, with a good flavour; eye closed, set in a deep rather broad basin; stalk about three-quarters of an inch long, set in a deep and regular cavity.

In season from February till June. The tree is rather a moderate grower, making slender wiry wood of a greyish brown colour; it comes into bearing early, and is a regular and good bearer.

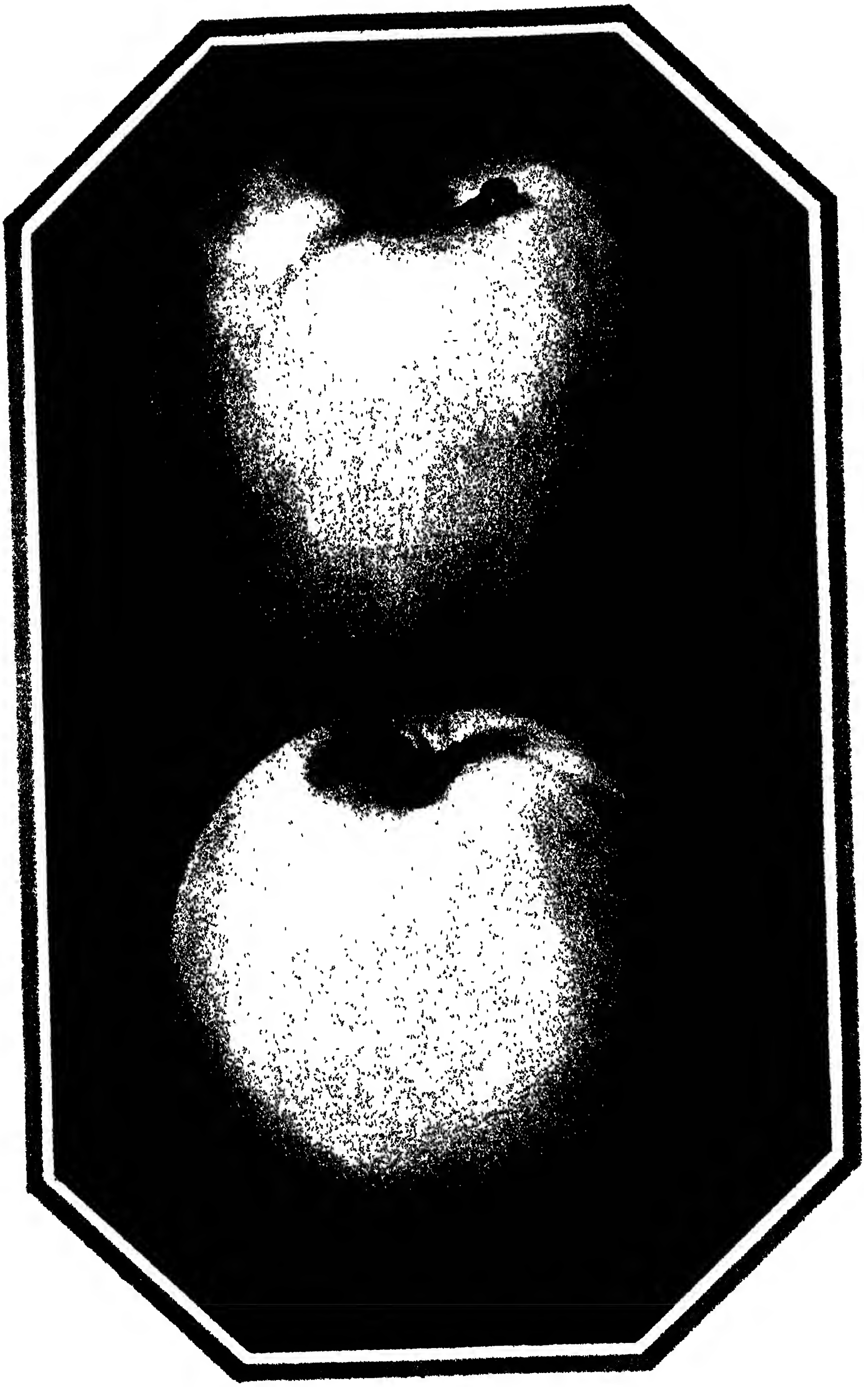
Downing says: "The original tree of this variety is growing on the farm of Mr. Philip Rick, of Kingston, New York. It was first described by the late Judge Buel, and named by him in compliment to Jonathan Hasbrouck, of the same place." It was introduced into Victoria by the Royal Horticultural Society about thirty-five years ago, and has become one of the most popular varieties with all market growers

The variety first introduced as Jonathan, when it fruited, turned out to be Esopus Spitzenberg, while the true Jonathan was introduced under the name of Marston's Red Winter. This gave rise to great confusion amongst the experts; to settle the matter the Jonathan was again imported from America, when it proved to be the same variety previously introduced as Marston's Red Winter.

Cleopatra, or New York Pippin.

Fruit medium size, about 3 inches wide at the widest part and 3 inches high, conical, even and regular in its outline. Eye closed, set in a small deep corrugated basin; stalk long and slender, set in a deep funnel-shaped cavity, which is generally of a green colour. Skin green, covered with small white specks; when fully ripe it is of a beautiful clear lemon-yellow colour with a fine clean skin—a most beautiful apple. The seed cells are often surrounded by a large hollow cavity, which sometimes causes decay; flesh white, tender, and juicy, with a fine sprightly flavour. It is in season from February till November, and is one of the best and longest-keeping apples. This variety is subject to bitter pit, especially on young trees, and on larger trees on which there is a light crop. Where the trees are bearing a good crop the fruit is generally clean and good. It is also subject to the scab (*Fusicladium dentriticum*), and should be carefully sprayed with Bordeaux mixture. This is one of the very best apples for export, especially in the warmer districts of the State, as it is one of the earliest export apples to mature; it can be shipped early in February Although the fruit may not have grown to its full size when picked, it will still ripen and colour without shrivelling, if kept closely packed. The origin of this valuable apple is unknown It seems to have been first introduced into Victoria from Tasmania. The trees in an old orchard at Harcourt, planted in 1855 or 1856 by the late Captain Smith, R.N., at that time Warden of the Castlemaine Goldfields, were obtained from Tasmania, and amongst them were some trees of the New York Pippin. Mr. L. M. Shoobridge, Glenora, Tasmania, writes me: "I had some trees in a garden planted about 80 years ago, and there were some New York Pippins in it, so it is evident that the variety has been long established here. I do not think it is a Tasmanian seedling."

This variety seems to have been known in the early days under the name of the New York Pippin; how, or when, it became known as Cleopatra the writer has been unable to ascertain. At one time it went under the names of Pomme de Roi, Pomeroy and Spanish Reinette. The late Mr. George Neilson, F.R.H.S., held strongly to the opinion that it was identical with the variety known in America as Ortley. To settle the question the Department of Agriculture imported that variety with some others from America, but, unfortunately, just when the trees arrived, Mr. Neilson resigned his position as Curator of the Burnley Gardens, and so the matter was lost sight of. Notwithstanding its drawbacks, this is one of the most valuable apples for export, and should be largely grown for that purpose. In Tasmania and South Australia it is also one of the leading export apples.



CLEOPATRA.

DISEASES OF FARM ANIMALS.

S. S. Cameron, M.R.C.V.S.

V.—NOTIFIABLE DISEASES UNDER THE "MILK AND DAIRY SUPERVISION ACT 1905."

By the coming into operation of the *Milk and Dairy Supervision Act* 1905 on July 1st, 1906, certain diseases of animals are created "notifiable diseases", that is, the fact of occurrence of any of these diseases in the State of Victoria has to be notified to the Department of Agriculture by the owner or the veterinary surgeon in attendance Failure to notify constitutes an offence against the Act, and renders the owner or veterinary surgeon liable to a penalty not exceeding £5 for a first offence, and not exceeding £50 for any subsequent offence.

The sections of the Act specifically referring to notifiable diseases are as follow —

"20. The following shall be notifiable diseases of animals under this Act:—

Anthrax,	Contagious abortion,
Black leg or symptomatic anthrax,	Swine fever,
Contagious mammitis,	Tuberculosis,
Contagious pleuro-pneumonia,	Variola vaccinia, and

Any disease which may from time to time be proclaimed by the Governor in Council by order.

"21. (1) When any animal at a dairy farm or dairy is affected with any notifiable disease the owner thereof shall immediately notify the fact in writing to a supervisor* or a member of the police force and in the notice shall state—

(*a*) his name and address,

(*b*) the address of the dairy farm or dairy where such disease exists,

(*c*) the kind of animals and number of animals affected with such disease.

(*d*) the name of such disease, and

(*e*) any action that has been taken in pursuance of the provisions of this Act with regard to every such diseased animal.

"(2) Such owner shall at once isolate any and every such diseased animal and shall unless otherwise prescribed keep any and every such animal isolated while such disease continues or as long as there is reason to think in the case of any cow so affected that there is danger of the milk of such cow being infective or contaminated or deteriorated as a result of such condition having existed.

"The word 'isolate' means the keeping of an animal in a separate enclosure in such a manner as to prevent actual contact of such animal with any cow being used for production of milk or cream for sale or with any animal having contact with such cow.

* All such communications should be forwarded direct to the Chief Veterinary Officer, Department of Agriculture, Melbourne.

"(3) Every registered veterinary surgeon or other person treating animals for disease upon it coming to his knowledge in the course of his practice that any animal is suffering from or is affected by any notifiable disease shall at once notify the authority of such occurrence.

"(4) A fee of Five shillings shall be paid by the authority to such owner or veterinary surgeon for such notification if the authority is satisfied that the report is correct. Only one such fee shall be paid in respect to any single outbreak of such disease."

Anthrax.

(*Synonyms. Cumberland Disease—splenic fever—splenic apoplexy—black rot.*)

Anthrax is the most ancient contagious disease of animals that is known. The sixth plague of Egypt referred to by Moses, was anthrax, and elsewhere he indicates the transmission of the disease from cattle to man by means of soiled clothing. Homer, Ovid, Plutarch, Dionysius, Livius and other ancient writers frequently refer to this disease; and in some cases their descriptions are most exact and plainly manifest the disease as we know it now-a-days.

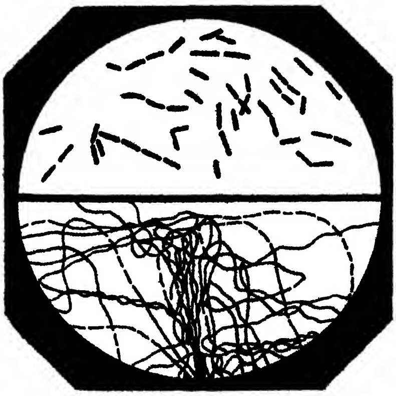
Anthrax exists in most countries of the world and has been prevalent throughout Australia for a long period, affecting cattle and sheep principally but horses and pigs in lesser degree. In New South Wales it was known prior to the seventies as Cumberland Disease (from its particular prevalence in the County of Cumberland) and the credit of definitely identifying and announcing this disease as anthrax belongs to the late Graham Mitchell, F.R.C.V.S., of Melbourne. Early in 1876 there was great mortality of sheep in the Western District of Victoria which was recognised as being analogous with Cumberland disease and identified by Mitchell as anthrax. His announcement was, however, officially discredited, much bitter feeling being engendered, and it was not till after Mr. Mitchell's death in 1888 that the correctness of the diagnosis was publicly admitted. A detailed history of the controversy on the subject, which was a lengthy one, is given in a brochure on "Cumberland Disease in Australian Sheep" published by Graham Mitchell in 1877.

DEFINITION.—An acute contagious febrile blood disease, affecting herbivorous and omnivorous animals (including man) principally, caused by the *bacillus anthracis*, and characterized by a general hæmolysis with engorgement of the spleen and other organs and by sudden onset, rapid course and almost uniformly fatal termination.

CAUSATION.—The *bacillus anthracis* was discovered in the blood of animals dead of the disease in 1850 by Davaine, and was demonstrated by him to be the specific cause of the disease thirteen years later (1863). It was the first disease-producing organism to be recognised, and the science of bacteriology may be said to date from its discovery. Usually, but not without exception, it is found in the blood of all parts of the body and in the spleen and other organs. Compared with others since discovered it is a large bacillus (5 to 20 microns long by 1 to 1.15 microns thick) and is distinctly rod-shaped with square ends. It is non-motile, aerobic,

stains by Gram's method or any aniline dye and grows freely on a variety of culture media. Grown outside the body it assumes a filamentous form and bears spores which are particularly resistant to extremes of temperature.

The anthrax bacillus is quickly destroyed in the presence of putrefaction and septic ferments, and as decomposition of an unopened anthrax carcass is very rapid the search for the bacilli may be fruitless if the examination is delayed till putrefaction is advanced. Not only may the bacilli not be found by microscopic examination, but the blood and tissues will not be infective to other animals after a few days except in those cases where, through admission of air, the bacilli have sporulated. In such cases the bacilli would have become disintegrated but the spores would produce anthrax in any susceptible animal inoculated. This fact has an important bearing on the diagnosis of the disease and also upon the suppression of its spread. It will be obvious that microscopical and bacteriological methods of diagnosis cannot be relied on except when the examination is conducted on comparatively fresh specimens. taken in a manner to minimize risk of contamination with putrefactive organisms.



A Anthrax bacilli in blood.
B. Filamentous development of anthrax bacilli on artificial culture.

Even as regards inoculation, Friedberger and Frohner set out that "inoculation gives negative results when the matter containing the bacilli is soiled by other microbes or is in a state of putrefaction."

On the second point, as to preventing the spread of the disease, seeing that spore formation in the bacilli does not occur in the living animal nor in the carcass to any extent if air and oxygen are excluded and that the bacilli themselves are quickly destroyed after the death of the animal, it follows that the risk of spread of the disease is greatly lessened if the carcass is not cut or opened up to contact with air. The germs are imprisoned, so to speak, and die from oxygen starvation. Any risk there is lies in the possibility of the discharges from the carcass containing bacilli which, on contact with the air form spores by which the contagion may be propagated. If, however, such discharges are collected and burnt along with the carcass, or buried deeply with it, the risk of spread of anthrax may be reduced to a minimum. It is this quick destruction of the bacillus by decomposition and the absence of sporulation that accounts for that sudden cessation of an anthrax outbreak which is so frequently

observed and which appears so inconsistent with the expected behaviour of a contagious disease.

When the bacillus has become liberated from the carcass it may be preserved in the soil and propagate for an almost indefinite length of time. This is more likely to occur if the soil is rich in organic matter, and hence moist alluvial lands are notoriously more retentive of anthrax infection than dry uplands. A paddock with anthrax-infected soil may not produce anthrax for years, until the occurrence of conditions which favour the transmission of the germs from the soil to the herbage. In very damp seasons the germs may be brought to the surface by the elevation of the water level on swampy ground; or they may be washed out by floods and deposited on the surface; or the excessive moisture may bring up earth worms whose earth casts may contain bacilli from an anthrax grave or infected soil; also grass or plants springing from deeply-buried seed and pushing up through rain-loosened soil may carry bacilli to the surface on their growing leaves. Again, anthrax may occur in very dry seasons when infected water-holes, swamps and morass land dry up and leave the germ-mixed mud accessible to stock. A growth of vegetation springs up on the mud coating, and stock often pull up such vegetation by the roots and so run further risk. Flies and insects of various kinds are also much more numerous during the dry summer season, and they are undoubted carriers of contagion.

METHOD OF INFECTION.—It will have been gleaned from what has been said about infection from pasturage that one of the principal ways in which the germ gains entrance to the system is in the food by *ingestion*. In addition to pasture, hay or other fodder grown on infected land is a frequent cause of anthrax breaking out on previously uninfected properties. In New Zealand anthrax in sheep has been traced to the feeding of growing root crops, in which case the likelihood of ingesting soil along with the food is very great. Root crops that have been manured with bone-dust supposed to have been contaminated with anthrax germs have been particularly blamed. Since the investigation of this phase of the subject by Mr. J. A. Gilruth, M.R.C.V.S., the New Zealand Government Veterinarian, imported Indian bone-dust has been held responsible for a number of outbreaks in Victoria and elsewhere throughout Australia.

INOCULATION is another method of infection, flies and insects conveying the germs from anthrax carcasses to wounds and abrasions on other animals. Inoculation may also occur through accidental wounds made with knives and instruments previously used on an anthrax carcass; in fact, this is the most common way in which man becomes infected with the form of anthrax known as "malignant pustule."

It is questionable whether the disease in animals is ever caused by INHALATION, but in man the pulmonary anthrax called "woolsorters' disease" is most likely caused through inhalation of the particles contaminated with anthrax germs which rise when dried skins, hides and wool are being handled.

FORMS OF ANTHRAX AND SYMPTOMS.—As a general infection anthrax occurs in hyper-acute, acute and sub-acute forms. The first of these is more usually described as *Apoplectic or Fulminant* anthrax. The animals, cattle or sheep mainly, are affected suddenly without premonitory symptoms; they have convulsions and die in the course of from a few minutes to an hour. The earlier cases in the anthrax outbreak at Keilor, Victoria,

in the beginning of 1903 were of this form, some of the cows being found dead within an hour of their having been observed feeding and apparently perfectly well. Others were seen to suddenly stop feeding, look round wildly, stagger and fall as if in a fit and die after struggling for a few minutes. The fulminant form of anthrax appears to afford an illustration of the phenomenon observed by various investigators that the bacilli are less numerous in the blood in proportion to the more rapid course of the infection. Quite often in these cases the bacteriological examination of the blood gives negative results because the bacilli are located or colonized in one particular organ or spot; they have not time to multiply to an extent sufficient to pervade the whole body before death results from the lethal effects on the central nervous system of the anthrax toxin formed locally.

ACUTE GENERAL ANTHRAX is a little less rapid. Death occurs in from two to twenty-four hours. During this time there is high fever with increase of temperature, tremors, excitement, grinding of the teeth, groaning, stupefaction or frenzy, staggering gait, spasms, laborious breathing. prostration and finally the convulsions which precede death. There may be great straining to pass fæces and urine, with frothy and blood-tinged discharges from the natural orifices. Emphysema or a gaseous distension under the skin may also be observed.

SUB-ACUTE GENERAL ANTHRAX.—In this the features are somewhat similar to those of the acute form only that the course is less rapid and the steps from one set of symptoms to another are more prolonged and defined. There may be intermission of symptoms for a time and the fatal culmination does not usually occur until the lapse of 36 or 48 hours, and it may be postponed for five or even seven days.

GLOSS-ANTHRAX.—In horses and pigs anthrax often assumes a local form affecting the tongue and region of the neck and throat. These become swollen and there may be also swellings on the shoulder flank and thigh which are at first hard, hot and painful and later on become doughy, fluctuating and cold. The tongue is greatly enlarged and blackened and may protrude from the mouth. There is inability to swallow and great difficulty in breathing.

POST-MORTEM APPEARANCES.—The carcass has a tendency to swell quickly, decomposition of the abdominal contents being very rapid. There is also a gaseous distension (emphysema) under the skin which on pressure gives out a crackling sound. Blood-tinged fluid effusions are noticed under the skin. In what may be described as typical cases but to which there are many exceptions the blood is profoundly changed, being black in colour and remaining black on exposure to air. It does not clot freely and has a tarry appearance. The lining membrane of the chest and abdominal cavities is dotted with patches of blood extravasation (ecchymosis) as also are the heart sac, the kidneys and the liver. The heart and large veins leading from it are filled with black liquid blood and the heart muscle is soft and relaxed. The lymphatic glands are always congested and may be spotted with hœmorrhages. The liver is usually enlarged, soft, friable and easily broken down. The lungs are engorged with blood and dropsical. The trachea and bronchial tubes contain bloody mucus. The mucous lining of the stomach and bowels is reddened and spotted with blood extravasations. In the spleen the most decided changes are observed. It is enlarged to two or three times

its natural size, and its structure or spleen pulp is softened, broken down and heavily charged with blood and fluid of a deep colour.

The appearances described are not likely to be all met with in every case, in point of fact "in the rapidly fatal cases the changes in the blood and tissues are often little marked" (Law); but even in fulminant anthrax there may usually be found localizations of the described appearances in some organ or group of lymphatic glands where colonization of the bacilli has occurred, and blood or tissues from such part will be found loaded with bacilli.

Prevention.—The carcasses of animals dead of anthrax and all matter likely to have become contaminated should be dealt with in the manner described under the headings "Disposal of Carcasses" and "Disinfection" in the chapter on Prevention of Disease. Lands upon which anthrax has become "enzootic," *i.e.*, where the soil is impregnated with the bacilli and the disease breaks out periodically, should if possible be turned from grazing use for a time and cultivated. The underdraining of low-lying, damp land is also to be recommended, not only because of the removal of stagnating moisture but also because of the soil aeration which draining effects. Under the slow influence of oxygen, anthrax bacilli are gradually robbed of their virulence. Seeing that anthrax is not usually conveyed from animal to animal by direct contact but is most often contracted from the pasture or food, a practical measure towards the prevention of its spread is the removal of all apparently healthy animals from the paddock in which the disease has been occurring to dry upland country. The mortality will almost at once cease, and even if an odd animal does succumb after removal the risk of contaminating the new paddock will be small if the precautions previously mentioned, as to disinfection and the non-opening of the carcass before burning or deep burial, are strictly observed. Besides, the anthrax germs are not likely to become permanently fixed on dry sandy soils.

Preventive Inoculation.—Immunization of flocks and herds by inoculation with an "anthrax vaccine" has been practised for many years with varying degrees of success. Some of the "vaccines" used consist of an attenuated or weakened culture of the bacillus and others of sterilized anthrax toxins. They are prepared in various ways—(*a*) by the action of heat (Toussaint), sunlight (Arloing), compressed oxygen (Chauveau) or antiseptics (Chamberlain and Roux); (*b*) by the cultivation of the bacillus in an oxygen atmosphere (Pasteur); and (*c*) by sterilizing anthrax blood and dissolving out the soluble toxins (Law).

Pasteur's method is the one that has given the best results and by it protective virus of two grades of virulence are usually used. The first is a very weak virus ("1st vaccin") resulting from cultivation in oxygen at a high temperature (42 degrees C.), to prevent the formation of spores for twenty-four days. The second or stronger virus ("2nd vaccin") is got when cultivation under the same conditions is carried on for twelve days. To inoculate, the prescribed dose of 1st vaccin is injected under the skin on the inner aspect of the thigh (sheep) or behind the shoulder (cattle) and fourteen days later the 2nd vaccin is similarly injected. The dose must be regulated according to size and age, but the average is $\frac{1}{8}$th of a cubic centimeter for sheep and double that amount ($\frac{1}{4}$th c.c.) for cattle. The protection lasts for about a year or more, after which re-inoculation is necessary.

It cannot be confidently recommended to practise inoculation for anthrax indiscriminately. It should never be practised except on anthrax lands, that is where the disease occurs periodically as an enzootic, as "elsewhere it may lead to the stocking of a new area with a maglignant germ (the anthrax bacillus) which in young and susceptible animals re-acquires its original virulence." Another drawback as regards sheep is that different breeds and families appear to possess a very irregular sensitiveness to the same virus; hence, in large part doubtless. the many fatalities that result from inoculation of sheep on the one hand and the many failures to protect on the other. In Australia the best results are obtained between May and September.

Law's method of anthrax protection by injection of sterile solution of anthrax toxins has been practised with success in America. The blood of an anthrax animal is heated for half-an-hour at 212 degrees F. to destroy the germs; it is then washed with boiled water to dissolve out the toxins, and the resulting solution is injected in doses of 2 to 4 c.c., as the protecting virus. The advantages claimed are:—(*a*) That the material can be prepared on the spot when dealing with an outbreak; and (*b*) that as the germs are destroyed, the risk of inoculating virulent anthrax or introducing it to a new area is avoided.

Blackleg.

(*Synonyms. Black-quarter—Quarter-Ill—Symptomatic Anthrax—Emphysematous Anthrax.*)

DEFINITION.—An acute infectious febrile disease, affecting almost solely young cattle, caused by the *bacillus Chauveauii* and characterized by fever, lameness and hot, painful swellings on the quarter, thigh, neck, shoulder or elsewhere which tend to become emphysematous and gangrenous.

This disease has only become prominently prevalent throughout Australia during recent years. It is a disease so common in England that it would be well known to imported veterinarians, and its occurrence would scarcely have escaped their notice, yet it was not till the late nineties that its existence was chronicled. Since then it has been the cause of considerable mortality amongst calves and young stock in many dairying districts. The incidence of the disease is practically confined to young cattle between the age of three months and two years. It seldom, if ever, attacks calves while still on a milk diet solely; this because of the fact that the germ is usually introduced from the soil when grazing.

NATURE AND CAUSATION.—For a long time blackleg was looked upon as a modification of anthrax but it is now known to be caused by a different bacillus, and while it has many features of an anthracoid character its clinical history, local symptoms and age period of incidence serve to easily differentiate it from true anthrax.

The actual cause is a bacillus, called the *bacillus Chauveauii* or *bacillus anthracis emphysematosus*, having the following features:—Rod-shaped with rounded ends one end being often larger than the other on account of the presence of a spore, so making the bacillus club-shaped. It is anaerobic, living in the tissues without utilizing the oxygen of the blood and being but rarely found in the blood in which oxygen is abundant;

motile, the movements being both undulatory and rotary; and sporulates within the body. It withstands putrefaction, and is found abundantly in the tissues a long time after death, even up to six months. A reference to the description of the anthrax bacillus will show that in regard to all the features just mentioned the bacillus of blackleg is the direct antithesis of the anthrax bacillus. Like the latter, however, this bacillus persists in the soil for an almost indefinite period and blackleg can be readily produced by inoculating the washings of marshy soils that have been contaminated a long time previously. The disease occurs under the same conditions and on the same class of country as anthrax. An obvious preventive measure, therefore, is to avoid depasturing young cattle on wet clayey or marshy soils during the age period of this disease. It would seem to be necessary for there to be wounds or scratches of the mucous lining of the mouth or alimentary tract before the disease can be contracted, for it is probably only conveyed by inoculation. In this connexion it is significant that the age period of the disease is synchronous with dentition changes, and it is likely that in the great majority of cases the inoculation

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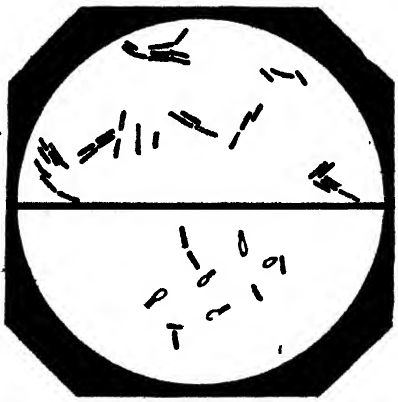


A. Bacillus of blackleg.
B. Bacillus of blackleg showing drumstick development.

occurs through the raw edges of the gums when the milk teeth are being cast. Pasturing on scrub or on spear grass or other rough herbage is also likely for obvious reasons to predispose to the contracting of the disease.

Lack of vigour through high condition on the one hand or through poverty on the other is a noticeable auxiliary cause, as also are chills and sudden changes of weather during the spring when young stock are shedding their winter hair.

SYMPTOMS.—The period of incubation or time elapsing from inoculation to the manifestation of symptoms varies from one to five days, the average being two days. The animal then becomes dull, feverish and depressed; there is loss of appetitie and rumination, and a marked increase of temperature. A stiffness or lameness in walking is then observed. This is usually confined to one limb and there quickly succeeds a swelling or tumefaction of the affected limb or of some other part of the body. The swelling is small at first but extends very rapidly and may acquire a considerable size in a few hours. It is hot and painful,

and when rubbed or pressed with the hand a crackling noise is heard due to the distension of the tissues beneath the skin with gas. Later the swelling becomes cold and insensitive, and on being lanced a dark-red frothy and offensive fluid exudes along with bubbles of gas. As the disease advances the animal rapidly weakens, the breathing becomes very distressful and, preceded by a rapid fall of temperature, death results in from one to three days.

POST-MORTEM EXAMINATION.—The carcass—the internal organs as well as the tissues underlying the skin—will be found greatly bloated or distended with gas. The tissues in the region of the swelling are engorged with dark, frothy blood; they are friable, breaking down readily under finger pressure and have a bruised pulpy appearance. The bacillus is present in this pulpy mass in large numbers. The lymphatic glands in the neighbourhood are enlarged and congested. The lungs, liver and kidneys are also usually congested but the spleen is rarely enlarged.

PREVENTION.—Recovery practically never occurs and curative treatment is useless so that quick destruction of all cases definitely diagnosed as blackleg is a wise procedure. The carcasses should be burnt and the disinfection methods and other preventive measures recommended in anthrax cases and for infected areas should be carried out in every detail. Cultivation of infected land is more successful in eradicating blackleg than anthrax, the aeration of the soil effected by the cultivation operations being inimical to the development of the anaerobic germ.

PREVENTIVE INOCULATION.—Immunity against blackleg can be produced artificially by subjecting the system of an animal to the action of the weakened toxins of the bacillus. This may be done by different method but that which has been most successful is the use of a weakened virus or "vaccine" prepared from the diseased flesh according to the method of Arloing. "Forty grammes of the diseased muscle are dried rapidly at 32 degrees C. (90 degrees F.) and triturated in 80 grammes of water. This is divided in 12 equal parts and put on plates in two thermostats, six at 100 degrees C. (212 degrees F.) and six at 85 degrees C. (185 degrees F.) where they are kept for six hours, when it forms a dry, brownish powder. One-tenth of a gramme (1½ gr.) of this powder is dissolved in five grammes of distilled or boiled water and will furnish ten doses. The animal to be protected is first injected in the tip of the tail or elsewhere with the virus prepared at 100 degrees C., and ten days later with that prepared at 85 degrees C." (Law.) A peculiar fact about the weakened virus so prepared is that its full virulence is regained by the addition to it of a small quantity of lactic acid.

The Pasteur Institute prepares the vaccine, and issues it in the form of short threads that have been soaked in a virus of required strength and afterwards dried. The threads are introduced under the skin by a special needle after the manner commonly practised in inoculation for pleuro-pneumonia. An American firm also distributes virus prepared by the Arloing method but in the form of solid pilules which are injected under the skin by means of a syringe fitted with a canula, needle and spring piston.

For the successful prevention of the disease on infected farms or in infected districts all the young cattle between three months and two years old should be inoculated in the spring and autumn. The two inoculations are necessary because the protection which it conveys only lasts about six months.

It should be mentioned that this method of immunizing stock against blackleg should be restricted to cattle on infected areas otherwise there is grave risk of introducing the disease into new country. Such risk is much greater if the inoculation is carried out during the hot summer season.

In New South Wales also blackleg is a notifiable disease, the penalty for failure to report being £50, and for selling or purchasing stock affected with it the fine is £100. Under the *Noxious Microbes Act* 1900 preventive inoculation by private owners without a licence from the Chief Inspector of Stock constitutes an offence.

THE MALLEE FRONTAGE OF THE MURRAY RIVER.

An Undeveloped Province of Victoria.

(Continued from page 266)

A. S. Kenyon, C.E., Engineer for Agriculture.

The Lands Around Mildura.

Carwarp, already referred to in connexion with the Nowingi country, lies immediately above the Mildura Concession. Since the first part of this article was published, the Victorian Government has decided to establish a settlement at Carwarp, along with the Nowingi lands, on lines laid down in a joint memorandum by the Surveyor-General, the Director of Agriculture, and the Engineer for Agriculture. These officers consider that the Mallee frontage may be successfully settled under special conditions suited to the locality. To quote their exact words:—

"We consider that its successful settlement can only be expected under the following conditions:—All homesteads to be on the river frontage in settlements of from twenty to fifty families, each homestead block to consist of about forty acres, of which twenty would be irrigated annually. Plant and works to be constructed and managed by the Government. Each settler to have a considerable area, from 400 acres upwards, of the interior land. This large block would be utilized for wheat-growing and grazing, as seasons permitted. The title for the homestead and wheat-growing blocks should be inseparable, and improvement conditions of a stringent character should be enforced. Residence on the homestead irrigation block, and systematic cultivation of the wheat block to be made compulsory. The limitation provisions of the Closer Settlement Act as to transfers of titles and continued application of residence conditions to apply.

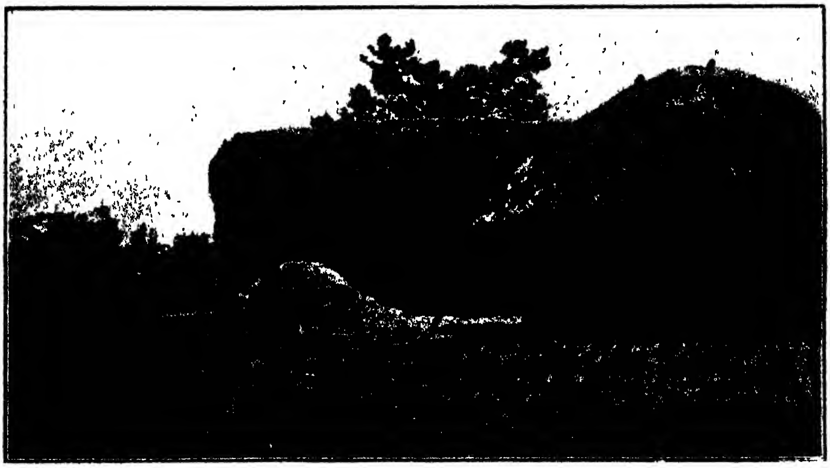
Care will be required in the selection of suitable settlers. Terms of payment should be made easy in the early years, and charges for irrigation should be levied. The Crown Lands charge for the land to be on the basis of its value, subject to irrigation advantages, but otherwise unimproved.

Carwarp, some thirty miles by the frontage track from Mildura, and ten from the Nowingi railway station, has been selected as a site to recommend for a first settlement. It forms part of an area reserved by the

Victorian Water Supply Department as an irrigation block, but since relinquished by it. The Nowingi subdivision of good land, suitable for wheat-growing but not capable of supply with permanent water, is within reasonable distance of Carwarp, and close to the railway line.

An area, containing about 1,800 acres, fronting the river at Carwarp has been roughly levelled and its suitability for irrigation ascertained. The cost of pumping plant, channelling, &c., may be estimated at £5,000, and this would suffice to supply water over the whole area, cut up into about forty homestead blocks. The river flats, about 1,000 acres, would be available for grazing, and could be used under commonage conditions, or otherwise, as might be arranged. The charges for irrigation water supplied should not exceed 15s. per acre per annum on the area irrigated.

The proximity of Mildura should insure a fair number of settlers conversant with irrigation methods. Settlers should possess some capital, either in stock, implements, or cash.



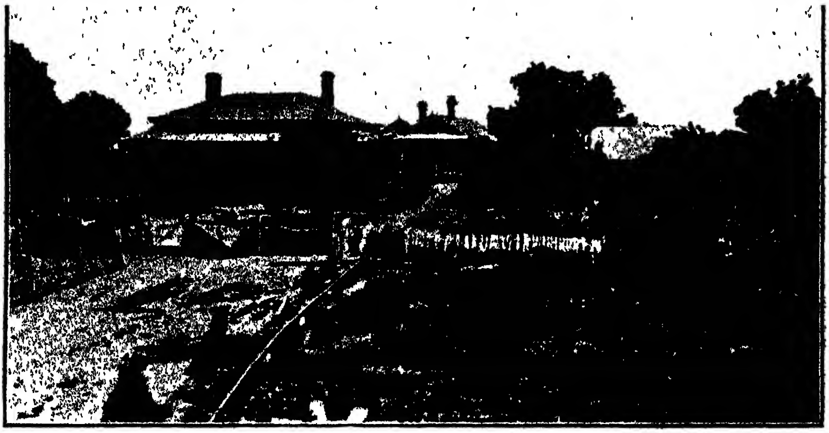
DROUGHT RESERVES, SOUTH AUSTRALIA.

There is much of the inferior Mallee land suitable for wheat growing, but on which the absence of water catchments renders it impossible to secure water storage, and on which it would therefore be futile to attempt residential settlement. By the utilization of the frontage lands (with irrigation), in conjunction with the back lands (without irrigation), this difficulty may to a great extent be overcome, and large areas now practically unused can be rendered productive, thus developing railway traffic or river traffic, according to position. Previously, the Murray waters question has prevented the prosecution of such a scheme, but the present favorable prospects of Inter-State agreement justify the submission of these proposals, which we recommend for consideration."

THE MILDURA CONCESSION.

Within the boundaries of the Mildura Concession, an area of about 200,000 acres, at present held under lease by the debenture-holders, the successors to Chaffey Bros. Ld.—but the term of which expires in 1911—there are large tracts of the finest quality of soil and timber. Sandalwood and belar (*casuarina lepidophloia*) predominate; there are also very

large areas of open grassy plains. This class of country runs right down to the river; there are but little river flats, and hardly any inferior country. Old salt-lake beds, or "copi" * flats, occur fairly frequently. Adjoining and above the present irrigation settlement at Mildura is Red Cliffs, an illustration of which appeared in the previous article. Here an area of about 25,000 acres has been alienated to the debenture-holders in exchange for other freehold lands owned by them. It is understood that, at an early date, the whole of this area will be brought under intense culture, on lines similar to Mildura; but avoiding, by using the experience acquired there, some of its initial errors. Pumping would be done by one plant, with a single lift, to the highest point of the settlement, and thence would be distributed throughout by gravitation channels. Only the classes of soil suitable would be irrigated. The chances of success of such a settlement should be rosy, though there may be some doubt as to the sufficiency



KULNYNE HOMESTEAD.

of the local market to absorb profitably the production from an area about twice as large as Mildura itself. Other markets, and oversea ones, must be obtained, and lower prices than our markets accepted.

COWANA.

Adjoining Mildura, but below it, and outside the limits of the concession, there are further areas of first-class land; high, it is true, but easily irrigated, the river being in close proximity to the greater part. Large billabongs, capable of being considerably improved and made into valuable storages, are numerous. The Water Supply Department, some few years ago, marked out an irrigation settlement area here, but no further action has been taken. The first-class lands extend back some 20 miles, until the desert or white-sand and porcupine country is reached, so that there are here practically no inferior interior areas.

The Frontage below Mildura.

Just below and immediately opposite the junction of the Darling River with the Murray, is Yelta, the site of another irrigation reservation. The important town of Wentworth lies some few miles up from the junction.

* Sulphate of lime, called "copi" by the natives, who used the material largely for decorative purposes as a paint, after being burnt.

Here the frontage changes completely in character, due doubtless to the different class of silt brought down by the Darling River.

THE RIVER FLATS.

From Swan Hill downwards to the junction, the box flats are comparatively narrow, and of small extent. The Mallee country—the red soil, as contrasted with the grey soil of the flats—comes in at frequent intervals to the frontage, and forms cliffs, more or less elevated above the river surface. The timber is fairly large, and has almost all been ring-barked. Below the junction, the flats are extensive, stretching back from the river some eight or ten miles. There is, as before, a certain extent of red-gum flats, growing a large amount of lignum (*polygonum*), willows (*acacia stenophylla*), and some grass. The distinction between the higher and lower box flats ceases to exist. Large open expanses of grey plain,

IN THE BACK COUNTRY, CABBAGE BUSHES.

almost wholly devoid of grass, stretch in all directions. Sparsely scattered about are plants of annual saltbush, and some creeping varieties. Dotted here and there are clumps of box, which require close inspection to make sure that they are box, and not some variety of myall. None of it has been ring-barked. Rarely more than 12 feet high, with its stems twisted and ragged, it is the most mean looking of all the eucalypts. Stumps of trees cut down in the early days of occupation to make fences which have since disappeared, show that the box trees have not grown perceptibly in the last 40 years. The soil is grey, and of a very close texture. It would not be suitable for continued irrigation without considerable expenditure on subsoiling and working. Nevertheless, an occasional flooding, a rare experience, produces a considerable amount of feed. Prior to the advent of the white man and his fleecy flocks, the flats were well covered with saltbush—old man, and the smaller varieties. These are almost extinct in Kulnyne, which occupies about half the distance to the boundary; although they are fairly thick on the lower half, Ned's Corner Run. It is not impossible that with a denser population and smaller holdings, the irrigation of these flats in a cheap way to start the growth of the perennial saltbushes, with some extent of cultivation of the annual varieties for the making of silage, will be found profitable. The experiment will be well worth trying later on. Low rises, a few feet elevation only, occur at infrequent intervals. They are of reddish soil, and run back generally to the Mallee lands; they are probably the caps of buried ridges and spurs from the high ground. One or two in Ned's Corner Run, particularly,

stretch right to the river, and would form suitable points for settlements. There is only one lake, Walla Walla, in the whole length, but this is well suited for storage.

The Mallee Country.

From these river flats rise the Mallee lands, all of the finest quality. They are equal to the best above Mildura, and are much more extensive. In fact, the disposition of the land is reversed below the Darling; above, the frontage is good, and the interior lands of only moderate quality, while below, the frontage is inferior and the back country first-class quality. The good land extends back some 10 to 12 miles, reaching a total distance from the river of about 20 miles, and abuts on the very poor white sand ridges north of the Cow Plains district. Considerable areas of saltbush are interspersed through its extent. Good water catchments are numerous, while the rainfall, though light, is apparently somewhat better than that of Mildura.

Rainfall.

The records of Ned's Corner Station cover a period of nineteen years, and the average precipitation is 10.20 inches. The records at Wentworth, however, for the much longer period of 35 years, and taken by an official observer, should be more reliable. They show an average rainfall of 11.75 inches. Lindsay Cliffs, in New South Wales, and Renmark, in South Australia, show rainfalls averaging over 11 inches. The mean annual rainfall may, therefore, be set down at a little over 11 inches.

Existing Settlement.

The country from Mildura to the South Australian boundary is held under grazing lease in two properties—Kulnyne and Ned's Corner. The so-called islands, that is, lands lying between the main channel of the river and its billabongs, of Walpoola and Lindsay, belong to the Council of Agricultural Education and are leased to the adjoining run-holders. Three homesteads, Cowra, an out-station, Kulnyne and Ned's Corner, with a few huts for boundary-riders, comprise the whole of the settlement. Wild dogs are numerous and destructive, and rabbits are running everywhere. The back country is fairly well supplied with tanks; but the insecurity of the present tenure precludes much work on improvements.

Settlement in the Neighbouring States.

A marked contrast is observable once this State is left. Driving through the Beardy Gate, in the vermin-proof wire-netting fence on the boundary, some 23 miles south of the Murray, into South Australia, evidences of agricultural occupation are quickly met with. A dairy herd of fair quality is first seen, then fences—for the Mallee, fairly substantial ones— appear. Several crops are passed, looking, despite a rainfall well below the average, very promising; parts of them bid fair to yield up to three bags per acre. Stacks of hay just carted in show provision against drought. Continuing, the Murray frontage is reached, all well settled with comfortable homesteads and large cultivation paddocks. Renmark, an irrigation settlement on similar lines to Mildura, is fairly prosperous, although it suffered severely from the heat wave at the commencement of last year. About 4,000 acres are irrigated annually, returning in fruit about £40,000. This yield may be expected soon to considerably increase, as there is a large proportion of newly-planted land, not yet, of course, in full bearing. Several

other irrigation settlements are being established by private persons or syndicates. In some instances, the irrigation of the flats, or, rather, the beds of large lagoons for lucerne growing and pig breeding, is being initiated; others are proceeding on the more accustomed lines of fruit growing.

VILLAGE SETTLEMENTS ON THE SOUTH AUSTRALIAN MURRAY.

To cope with the unemployed problem, and also to experiment with co-operation, there were formed, in 1894, some eleven settlements on the River Murray, on more or less communistic bases. The Government assisted the settlers by loans, and by the construction of pumping plants. Lack of practical experience and inability to maintain the communistic ideals without disagreement, led to the practically total failure of these ventures. Lyrup, near Renmark, but on the opposite side of the river,

A SOUTH AUSTRALIAN SETTLER'S CROP, NOVEMBER, 1905.

is an exception, and is moderately successful, its proximity to that settlement giving the settlers a chance of learning how to irrigate and cultivate successfully. The abandoned settlements, with the pumping plants, have all been leased for irrigation purposes. The soil, the climate, or the water supply cannot be blamed for these failures. The cause must be sought in the other element necessary to success, and that is man himself. Human nature does not appear to be yet ready for the communistic ideals; certainly not where initial conditions are adverse.

NEW SOUTH WALES.

New South Wales has not done so much with her frontage as South Australia. Only one irrigation settlement, the Wentworth, has been started. It is, as yet, anything but successful, although recent reports show improved prospects. The soil is principally river flats, requiring heavy and frequent waterings, and much cultivation. It is also in parts very saline. Along the frontage, however, are numerous settlers, generally holding under lease, at very low rentals, large areas, including the back country.

Some very fine instances of successful farming are to be met with. Just opposite the most northerly part of Victoria, is Lindsay Cliffs, a farm owned by Mr. Wilkinson. The mail route from Morgan to Wentworth passes close by, and a post-office and police station, known as Cal Lal, adjoin. The area of the farm is 2,030 acres in all, some 600 acres being freehold, and the remainder leasehold. Mr. Wilkinson went there 23 years ago with some hundreds of pounds in cash and stock; his property is now worth nearly as many thousands.

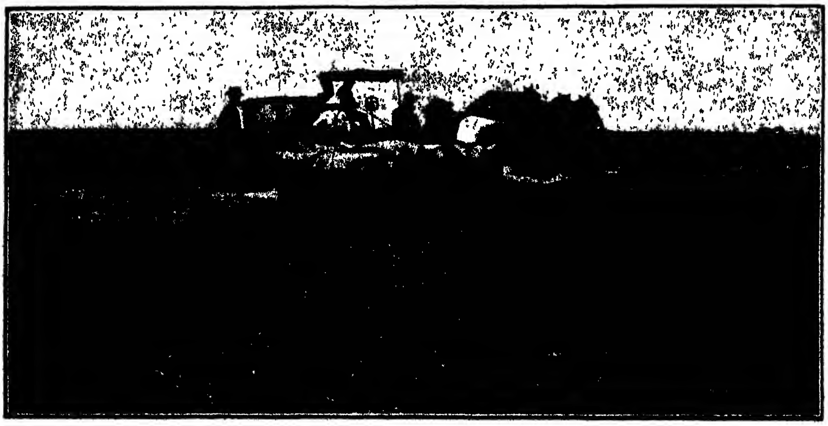
The farm, as an example of successful pioneering under adverse conditions, merits some description. About 30 acres of the frontage is irrigated for fodder, the produce being almost wholly consumed by the working and dairy stock of the farm, comprising some 25 horses and 20 cattle. There are, besides, about 250 sheep grazed on the stubble and fallow. The main reliance is placed on the wheat crop, for which about 600 acres are cropped, a similar area is fallowed, and land cropped the previous year is allowed to stand one year for grass. About 100 acres are cut for hay, there being a lucrative trade on the river for chaff. The average yield

STRIPPING, LINDSAY CLIFFS' FARM.

for the 22 crops harvested is a little over 10 bushels per acre. A new variety of wheat has been cultivated for some years past. The results so far obtained show that an average yield of about 12 bushels per acre would have been obtained had that particular variety been grown for the whole period. Last season, up to 18 bushels per acre were stripped, and the average came to over fourteen. The rainfall for that year was only 8 inches 68 points from January to November inclusive. A very nice orchard, a healthy vegetable garden, and many flowers and shrubs surround a stone-built house, roomy and comfortable. A large wharf, with sheds containing a portable engine driving the centrifugal pump, a flour mill, saw-bench, lathe, and chaffcutter, is close to the house. Large implement sheds and barns hold the latest farm machinery and an ample supply of fodder. A smithy and carpenter's shop contain a more complete set of tools and appliances than are generally to be found in our country towns. The farm gates are of iron, flat and round iron and tubing being used. All this has

been achieved with a rainfall of 11 inches on land generally reckoned useless for settlement except in very large areas.

This account of what has been done in the other States in utilizing the Murray frontage would at first give the impression that we are much behind those States, and have lost considerably by our delay. This is not so in reality. The frontages were held under leases granted in 1883, and expiring only at the end of 1903, just after a protracted period of exceptional droughts. Since then, the scheme of settlement, outlined in the Departmental memorandum quoted above, has been under consideration. The country has been examined, and surveys have been made of selected localities under the supervision of the Surveyor-General, to whom the credit for suggesting the present scheme of settlement must be given. The problem of utilizing our frontage lands so that the interior and really dependent country may at the same time be brought into profitable occupation is no light one. The experiment now to be entered upon with the approval of the Government will need to be carried out with great care, for on its successful issue depends apparently the provision of homes and livings for



WINNOWING, LINDSAY CLIFFS' FARM.

at least 3,000 families. The establishment of such a number of settlers with the inevitable business men and artisans along the Murray River will lend a different aspect to the navigation problem. Locks will be almost essential, both for water carriage and for reducing the lifts of the pumped water.

The Mallee fringe already occupied comprises some three to four millions of acres, of which about one million acres are under cultivation, with returns of over one million pounds sterling per annum in wheat alone. These settlers have survived the most disastrous series of droughts experienced since the settlement of the colony, and are now prosperous. It is not so long since it was asserted, and with much support, that it would pay the State to buy out all the Mallee settlers and allow the country to revert to its original state. The Murray frontage settlers, with an assured water supply, an assured irrigated supply of fodder, and, on the whole, better land, should enter upon their work with even greater prospects of success.

THE COMBATING OF TUBERCULOSIS IN CATTLE AND THE HYGIENIC PRODUCTION OF MILK.

(The Proceedings of the thirty-fourth Plenary Meeting of the German Council of Agriculture, 8th February, 1906.)

His Excellency the Right Hon. Professor Behring, of Marburg, said:—Gentlemen,—The combating of tuberculosis in cattle, and the hygienic production of milk are two questions in which not only cattle breeders and dairymen, but all classes of the population, are deeply interested. Consequently, we find these subjects placed on the order of the day at medical and veterinary congresses, at agricultural meetings of societies for the public welfare, and even in the counsels of the State. In a short report like this, I cannot, of course, touch on every point connected with the two problems; but must confine myself to describing as succinctly as possible what I have myself ascertained to be new and useful in the course of my own investigations.

The question of tuberculosis in cattle has, as we all know, two different aspects—the economical aspect, which chiefly interests agriculturists and the States; and the sanitary aspect, which interests every individual unit of the population. From the economical point of view, and according to the latest computation, tuberculosis in cattle causes a pecuniary loss of 30,000,000 francs (£1,200,000) in France. I have had the opportunity of studying the calculation made by Professor Lorenz, in the Grand Duchy of Hesse. He reckons that among the 300,000 head of cattle in the Grand Duchy, there is an annual loss of meat from this cause to the value of 500,000 marks (£24,500). These are figures the great importance of which must be clear to everybody, and it cannot be called an exaggeration when it is said that cattle tuberculosis lies on agriculturists like a heavy burden, or like a grinding tax, beneficial to no one, of at least 1 per cent., on the whole turnover from milk and beef. According to the figures which I have had an opportunity of seeing, this annual turnover amounts in the German Empire to more than 2½ milliards of marks (£122,500,000), so that, if we assume the damage from cattle tuberculosis to be 1 per cent., we get a total loss from this cause of 25,000,000 marks (£1,225,000) per annum, which is about equal to the loss in France. But this loss, which can be reckoned in money, is not the only one caused by tuberculosis in cattle; it involves one still heavier in the twofold sacrifices of human life. Firstly, by the transmission of the germs of consumption to infants nourished by infected milk, and, secondly, by directly increasing infant mortality, for the milk from tuberculosis cows in its raw state is not a proper substitute for mother's milk, carrying with it, as it does, this danger of transmission of disease, whilst the treatment by which it is sterilized, and rendered innocuous at the same time, deprives the milk of its nourishing qualities.

Therefore, it was a thankful task to search for some means whereby tuberculosis in cattle could be done away with, and it is not to be wondered at that when veterinary authorities and Government boards came forward with the statement that my bovovaccination is an efficacious remedy, a very widespread interest was shown, and all such statements were followed with the greatest attention. Another factor probably played an important part in exciting interest, namely, the hope that as a method has been

found preventing the transmission of the germs of tubercle from cattle to mankind by means of inoculation, so might a means be discovered of protecting human beings by direct inoculation from the transmission of the germs of consumption from other human beings.

And, indeed, it is only natural to suppose that what is possible in lower animals should also be possible in the human race, when we consider that the most important healing processes have been arrived at through experiments on animals. At the close of my lecture, I will say as much as my investigations up to the present time will admit as to the possibility of combating tuberculosis in human beings by new methods. But at present I must confine myself to the subject imposed upon me by the Council of German Agriculture, namely, cow's milk as an article of food, firstly for infants, and secondly for the human race in general.

In cities, especially in large cities, more than one-half of all the infants born have to be fed with substitutes for mother's milk, as the mothers either cannot, or will not, suckle their infants. And it does not seem as if the outcry in favour of natural feeding will have much effect in the near future. On the contrary, it seems as if it were a law of nature that when woman gives up domesticity in order to take part in public life, she loses not only the inclination but also the capability of suckling her own child. (Hear, hear.)

With us in Berlin, two-thirds of the infants born have to do without mother's milk, and let it be noted that it is not among the poorer classes that the greatest percentage of artificially nourished exists. No, the highest percentage of artificially nourished infants is found among families paying the highest rents.

The most frequent substitute for mother's milk—cow's milk—would also be the best if it could be supplied to the child from a healthy cow, in a perfectly clean manner, and in the same fresh state as the naturally nourished child obtains its mother's milk. But this, as we know, is not the case; there is often a delay of from 18 to 36 hours before the infant can get its milk, in which interval the milk undergoes many changes, and is not at all the same article of food as it was in its first state.

And now a word about these changes. They are well-known, and perhaps seemingly trivial, but it is well to realize the chief cause of them. Judging from my own experience, I should say there were two sorts of change, one a natural change, resulting in the sour fermentation of milk, and the other an unnatural change, which we may call an alkaligenous fermentation, whereby the milk remains fluid. In the sour fermentation, the fatty substances rise to the top, while the caseine becomes curdled, and is suspended in the whey or milk serum. This is a process similar to the coagulation of blood; except that we know that the curdling of milk is accompanied by the presence of micro-organisms of bacteria, which produce acids, and this more especially when the oxygen of the air has free access to the milk.

The other, which we call the alkaligenous fermentation, is quite different. This takes place when the oxygen of the air is excluded or driven out; for instance, by heating the milk. The best way to drive out oxygen from a fluid is to heat it. The result is that milk kept in closed bottles is apt to undergo, not the sour, but the alkaligenous fermentation—in other words, to become putrid. We speak of the fermentation of an organic fluid when non-nitrogenous substances are decomposed in it: when, on the

other hand, albuminous (nitrogenous) substances are decomposed in a fluid we get the condition which is called putrid. The milk, which has undergone the alkaligenous fermentation, and which does not curdle, yields compounds of peptonised albumen, which have a smell and a bitter taste and a tendency to the development of gases. Sour fermentation gives us a milk which is still excellent food, though not for infants. The secretion of the caseine and fatty substances prevent it from being in itself a proper food for infants. But sour milk can very well provide food for infants in the forms of butter-milk and whey, both of which have proved an excellent basis for infant feeding, even in cases of mal-nutrition. It is true that carbo-hydrates must be added to the butter-milk because the separation of the fatty substances and of the milk-sugar which passes over into the whey induces a lack of non-nitrogenous substances. Similarly whey must be specially prepared, and this is a very important point; but all eminent children's doctors are unanimously of opinion that the two fluids produced from sour milk, namely, butter-milk and whey, form excellent nutritive material for infants and young children. And however strange this may at first have appeared to scientific men, it is in reality quite natural. The constituent parts of the milk which the infant has need of for his nourishment, and which cannot be replaced by anything else, are not the fat and sugar, which can be given him in many other forms. No; what is absolutely necessary to him, so necessary that he becomes ill if it is withheld from him, are the component parts found in the milk serum—albumen, blood-forming iron, and bone-forming lime. These substances are retained in sour fermentation, but they are totally destroyed in the process of putrefaction. We cannot feed an infant properly with milk which has undergone alkaligenous fermentation; but we can very well feed an infant with the above-mentioned substances taken from milk which has undergone the sour fermentation, for the very sourness prevents further decay—a most admirable provision of nature. I should like to call attention to the fact that comparatively little has been done, even by scientists, in the way of investigating the mineral components of milk by means of experiments on animals. When experimenting on food stuffs, it becomes very clear what an important part is played by the inorganic component parts of milk. There is much talk of milk ferments, and it seems to be believed that these are special substances in the milk, but the investigations which I have been carrying out for several years in my laboratory have shown that the milk ferments are, as a matter of fact, closely connected with those substances in the milk, containing iron, lime and magnesia, which we must realise as being combinations of iron, lime and magnesia, with certain very coagulable albuminous substances. There is still another substance, which is destroyed by the alkaligenous fermentation or putrefaction, and that is the nerve-forming substance, a fatty matter, but one which differs from the fatty matter of butter. Lecithine is also an important element. All these substances are well conserved in sour milk, but they are destroyed in milk which has undergone alkaligenous fermentation.

And now comes a point which must possess extreme interest for cattle breeders and dairymen, namely, that we can repeat the process of alkaligenous fermentation, with all its characteristic features, by the simple heating of fresh milk. By extreme heating of fresh milk, the genuine coagulable albuminous substances are denaturalized. Albuminate is first produced, and then, by further heating, pepton. The milk assumes a

more or less pronounced boiled taste, which gives place later on to the bitter taste of pepton. In boiled milk, all the fermentative qualities disappear, and this I believe to be caused by the disintegration of the albuminous substances combined with the mineral constituents of the milk.

It would, however, be erroneous to exaggerate the disparaging criticism on boiling milk. We are indebted to Pasteur for a process calculated to render the milk bacteria harmless, and at the same time to conserve the natural qualities of the milk. He it was who first called attention to the fact that milk fermentation was caused by bacteria, and who, by his epoch-making discovery of *contagium vivum*, gave a startling proof of cause and effect between bacterial propagation, and fermentation, and putrefaction. I allude to the process of Pasteurising, as it is called, a name which is much too loosely applied in the general tendency to call any sort of milk-heating Pasteurising. Pasteur's process consists of heating milk up to 75 degrees, not higher, and for no longer than half an hour, after which the milk *must* be quickly cooled. I have made the experiment not only with cow's milk but with mother's milk, and find that when quite fresh milk is so treated, it retains the fermentative and cell-forming qualities of milk. It is quite a different matter when milk is heated up to 80 degrees, 85 degrees, or more, all these qualities then being lost. Perhaps I may have time to return to this subject, and point out that by my feeding experiments on calves I have been able to show indisputably that it is impossible to rear healthy calves on milk which has been brought to a high temperature or boiled at 100 degrees. This is not an experience confined to cattle on my own property near Marburg; but one which has been made on estates in Bohemia and Hungary. On the Hungarian estates of Prince Louis of Bavaria, and on the Teschen estates, hundreds of calves have been under observation, some of which have been fed on uncooked milk, and others on boiled milk, showing that milk brought to a high temperature is not suitable for the normal rearing of calves. In the eighth number of my contributions to Experimental Therapeutics, I have given detailed reports of a series of these experiments.

Although I have expressed my approval of Pasteur's method, I must nevertheless mention that it is not always free from danger. If milk which is not fresh, but which has always begun to undergo the alkaligenous fermentation, is heated to a temperature of 75 degrees, the same changes take place as is the case if fresh milk is heated up to 100 degrees. It has been recognised by many children's specialists that milk brought into the house in the first stages of decomposition, and then heated, is the chief cause of many children's diseases, as, for instance, the scurvy-like Barlow's disease, and the rachite disease. All this can be produced in calves, too. I have spared neither time nor money to solve this question, not only in theory but in practice. I have fed a great number of calves regularly with heated milk, and have found that the diseases similar to scurvy and the bone malformations of rickets can be produced artificially, and when I took milk such as is generally given to infants in our large towns, that it was the surest way to kill most of the calves by setting up an exhausting diarrhœa; conditions similar to those that we deplore during the periods of high infant mortality in the summer months.

The subject of milk heating is a complicated one, and cannot be dismissed in a few trite words. But one thing I must say, as a result of my experimental studies, that sterilised milk is not ideal milk, nor yet is unsterilised milk necessarily the essence of everything evil. One fact remains

—statistics and experience show that on perfectly good cow's milk, we can rear up men and women in every way fit to fight the battle of life, as those who have been suckled at the breast, but we cannot say the same about sterilised milk, which is now so highly praised as infant's food.

From all this, you see that the milk question presents a real dilemma. We cannot supply milk fresh from the cow's udder into the houses of the consumers in large cities at moderate prices, and yet we must not employ the sterilising method of heating on account of its deteriorating effect upon the milk. It may, therefore, be imagined that it was a pleasant task to me to search for ways and means of obviating the deleterious effects of bacteriological decomposition, while at the same time conserving the milk so long in a proper state as to enable it to be conveyed to the consumers' houses for infant feeding. It is a great pleasure to be able to inform you, gentlemen, that years of observation have shown this not to be so very difficult after all. I do not speak of formalin milk; I do not allude to the other antiseptic remedies which have proved so valuable to agriculturists in combating mortality among calves. I allude now only to the simple and well-known methods of hygienic cleanliness in the cow-house, which methods I have treated on at some length elsewhere (see "Principles of Milk Hygiene," in No. 8 of my contributions to Experimental Therapeutics), and, lastly, to the proper selection of suitable milk cows. What I have already published need not be repeated, but I should like to call your attention to two things which, as far as I can see, have not yet been sufficiently noticed, at least not in Germany. But first I should like to give some examples of what can be done by the aforementioned means. Last summer, in the hottest months, on my small estate, about a quarter of an hour from Marburg, I had milk from selected cows milked straight into wide-necked bottles. The bottles were closed, and transported to the Institute of Hygiene, the thermometer standing at 20 degrees, and for five or six days these samples of milk kept so fresh that they could be used as sweet milk. I have, moreover, been authentically informed (one case I know of was in Saxony, another in Berlin) that bottles of milk were transported to America and back again to Germany after special precautions for cleanliness had been taken, and the milk still found to be in a perfectly good and drinkable condition. The best results, however, in milking that I have hitherto heard of have been attained by Dr. Willem, in Laeken. With the support of the Ministry of Agriculture, he keeps a certain number of cows under such conditions that he can send milk every day to Verviers, Ghent, and Brussels. It is delivered to the consumers in such a state of purity as regards germs (under 100 germs to the cub. cm.), as is only found in a few exceptional model German dairies. But this is not all. Of the milk thus sent (and this is a business enterprise, not an expensive scientific experiment) some samples are always forwarded to the Hygienic Laboratories in Verviers, Ghent, and Brussels, where they are examined in order to see how long they remain in a state of purity as sweet milk. Thirty-five successive investigations have shown that not a single one of these samples of milk curdled sooner than on the eleventh day; most of them not till between the twentieth and thirtieth days, some lasted fresh till the seventy-fifth, and one till the ninety-third day. These results exceed everything that one could venture to hope. When I learned that Willem's statement of his results was received in many quarters with scepticism, I took measures to inform myelf of his method of procedure. I know Willem to be an extremely trustworthy in-

vestigator of milk, and therefore I can guarantee what he says. The attainment of such excellent results was only possible under two conditions, conditions such as we have hardly contemplated as yet; firstly, the establishment of a special milking room for cows giving children's milk; and secondly, the careful selection of cows suitable for the giving of milk poor in germs. There is only a very small percentage of such cows.

As regards the taking of milk cows into a special milking room, this demand has been approved, at least in principle, in many quarters. I have already seen such milking rooms on a farm near Dresden, in Ohorn, and in other places, though these did not come up to the requirements of a model milking room. There would seem to be too little stress laid on the testing of the air in such rooms for germs, and on seeing that the air is pure enough to meet the demands of an aseptic milking room. I should like to relate my experiences in my own stalls during the last few weeks in the experiments of the well-known children's specialist, Dr. Salge, who has been appointed assistant to Privy Councillor Heubner. Dr. Salge has made very careful comparative experiments, testing the air of the cow-house where the animals are fed, for germs. He was especially careful in testing the air of a separate milking room which I had built into the cow-house, with the result that this room, which seemed to be perfectly fitted for its purpose, and which could be disinfected with steam, was found to be quite unsuitable to the requirements of a milking room for obtaining germ-free milk from healthy cows.

On the other hand, when the animals were milked in a spot on the meadow behind the farm-yard, where the air was almost free from germs, we found all the requirements of an aseptic milking room fulfilled in the simplest way.

Looking at this question, therefore, from a practical point of view, it is very simple to avoid speedy fermentation of the milk. In summer the cows must be milked in the meadow, where there is no dust; in winter, the same difficulties do not arise, and thus we take a very simple step forwards for the provision of milk suitable for infant feeding. But that is not all. You can build the finest model cow-houses—you can fulfil every condition I have laid down, sparing no expense, and yet you may be unable to obtain anything approaching the results obtained by Dr. Willem and myself. And for this reason: a very great deal lies with the cow itself. From recent experiments, made by Dr. Willem and myself, it has been found that in the udder of a healthy, cleanly-kept cow there are no living and propagating germs at all. The milk of a normal milch cow, an ideal milch cow, kept under perfectly healthy conditions, should therefore contain no germs whatever. As a matter of fact, however, there are very few such normal cows in our cow-houses. For instance, among my own 30 milch cows, hardly 10 per cent. even approximately approach the condition necessary in a normal cow.

Now comes another remarkable point. When these cows, which yield so many bacteria in their milk, are carefully examined, it is found that it is by no means the whole udder which is infected by bacteria, but perhaps only one quarter, or, at the most, two quarters, of the udder, the other quarters being normal. We have carried out a great number of excessively troublesome experiments in Marburg, and have convinced ourselves that a cow may have a positively healthy appearance and yet yield an

immense quantity of bacteria from her udder. There is no defect perceptible in herself, or her udder, and yet in a sample of her milk sphærobacteria, so-called streptococci and staphylococci, are found coming from one teat alone in such enormous quantities that this single cow is capable of spoiling the milk of the whole dairy. The fewer of these coccus cows there are the easier it is to keep down the germ contents of the mixed milk of the whole dairy, and from all this it may be understood that, in spite of the finest model dairies, one may be unable to obtain satisfactory results unless one weeds out the so-called coccus cows. We have succeeded in finding a way of sterilizing the udders of these cows, so it is clear that the question need only be approached in the right way to find a satisfactory solution, and to abolish great evils.

And so, gentlemen, without my going into further details, you will see that we are not far from attaining such conditions as will make it possible to obtain milk for infant feeding which will keep fresh from four to six days. When the milk is supplied to consumers in a fairly germ-free condition, there is no objection to its being heated up to 75 degrees C., for not longer than half an hour, or to 80 degrees C. for not longer than a few minutes. If the milk has already been Pasteurised, or otherwise heated before delivery to consumers, or when it has begun to ferment, this is not the case; an alkaligenously fermented milk-remaining fluid would, more especially if boiled in the house, produce an extract of bacteria, yielding no albuminous substances suitable for infant feeding, no blood-forming, no bone-forming, no nerve-forming substances; an excellent medium for bacteria, for vegetable organisms, but unsuitable for the maintenance of animal life. If I may be allowed to use a strong expression, I would say such milk is putrid, and may be classed among manures; it is fit for the dung-heap or the ploughed field, but should have no place in the stomach of a human being, and, least of all, in the stomach of an infant. (Hear, hear.)

If you were to question specialists, you would find that their private views are not so very different from my own. Publicly there are, of course, conflicting interests, which have to be regarded; there are charitable organisations, which would receive no subscriptions if the excellence of their method of sterilizing milk were to be doubted, there are the theorists who are so strongly committed to one method, that they would find difficulty in publicly advocating more recently discovered truths. But go to them in private, and they are quite of the same opinion as myself, and say: "We quite agree with you, we only require milk that we can give to infants just as it is, and without fear of infection." If you were to go to Professor Heubner at the charité, he would say, "I would rather pay 7d. per litre for milk that I can give to infants in its natural state, than half the price for sterilized milk." And this is self-evident. You have only to imagine the adoption of sterilization of mother's milk as it comes from the breast, in such a case you would, in all probability, have worse results than we now have with cow's milk.

But, this being the case, how comes it that the sterilizing of milk could become so widely advocated, and that even medical authorities encourage it? There are many reasons for this. In the first place, I believe it is in a great measure due to the widespread erroneous idea that the human organism is best protected against disease when it is kept in atmosphere, and fed with food, both totally free from bacteria. This is a dangerous error. Experiments made in the Pasteur Institute in

Paris, and by Schottelius in Freiburg, have shown that a newly born animal, human or otherwise, cannot by any means be brought up on sterile food. It would suffer from the lack of agencies which must assist in the function of digestion if this is to be performed properly. So we cannot approach these questions in such an erroneous spirit. When I emphasize this, it implies no contradiction of the fact that there are injurious bacteria. You, yourselves, gentlemen, know better than other people, from the investigations you have made of the root bacteria in your legumes, that, while there are bacteria injurious to your vegetable crops, that does not contradict the other fact that there are useful and harmless micro-organisms. We do not by any means conceal the fact that there are micro-organisms in milk which cause disease, those, for instance, which cause anthrax, and foot and mouth disease. Cows whose udders contain the cocci I have spoken about, though they may appear quite healthy, must be weeded out from the list of those that can supply us with milk for infants in an uncooked state. There are, however, other germs of disease quite unconnected with cows, which may be transmitted by the milkers. During epidemics of cholera or typhoid fever, dysentery, and other human diseases, milkers, who may be ill without being confined to bed, can easily transmit the germs of these diseases to the milk. It only has to be considered how far from cleanly in their person some of these milkers are, as they often have gatherings and sores on their hands, skin diseases, coughs, &c. These evils are patent to the most superficial observer; but from this I do not argue that it is necessary to sterilize milk; but only that as regards milking itself, as well as the way the milk is kept and treated, we should be guided by the same considerations which determine our actions in the question of drinking water. It would not occur to any one to lay down the axiom that drinking water must be sterilized; though drinking water, as an article of human food, is not nearly so coagulable as milk. The demand that milk should be kept as scrupulously clean as drinking water, I hold to be not only justifiable, but I feel convinced that this demand will, in a very short time, be officially formulated.

I think that this principle might have been accepted long ago, but that the means were lacking to enforce it, and as is so frequently the case in human life and practice, difficulties which we cannot solve, we pretend not to see. As the matter now lies, I hope I have shown you that it is not a matter of extreme difficulty to obtain and keep milk under such conditions of cleanliness that it can be conveyed to the houses of consumers in a perfectly fresh state for infant feeding. And where the possibility exists, the will will always find the way.

I must, however, mention a further condition, which must be fulfilled before we can give cow's milk in its natural state to infants. This is a condition which has seemed, up to the present time, impossible to fulfil, viz., that the milk should be entirely free from tubercle bacilli. And this condition presents a difficulty, it would almost seem an insurmountable difficulty, in giving milk in its raw state, seeing how diseased our cattle are with tubercle. It is no use lapsing into generalities on this question, time does not admit of it. I will, therefore, come straight to the point, and say that I believe I have found a means of overcoming this last difficulty. I am firmly convinced that in bovovaccination, we have a means of obtaining cattle free from tuberculosis, and in a manner easy of practice; at any rate, much easier than the experiments made with the Bang method.

You are doubtless aware that I am not alone in sharing this conviction. The scientific basis of bovovaccination has been sufficiently confirmed by veterinary authorities in various districts and countries. I need only mention the veterinary colleges at Giessen, Darmstadt, Freiburg, Leipzig, Budapest, Alfort (Paris), and Lyons, where there are men whose names are well-known in veterinary science, who have scientifically tested my method of inoculation for the combating of tuberculosis in cattle. The most valuable experiment has been made by Vallée, successor to Nocard, as director of the greatest French veterinary college at Alfort, near Paris. Out of the 40 cows which he inoculated with my bovovaccine, closely following my directions, there was not one single failure. Clinical observation as well as subsequent dissection, showed conclusively that at the end of a year, during which period the same number of cattle kept for comparative observation, had all become tuberculous, every one of the 40 cows inoculated with bovovaccine remained in a perfectly healthy condition. These results made such an impression that at a great meeting held at Melun, at which Vallée read a paper on the subject, a telegram was sent to me saying that those assembled had special pleasure in informing me that I had achieved a triumph with my bovovaccine similar to that which Pasteur had achieved there 23 years before with his anthraxvaccine.

As you are aware, Pasteur was not a doctor. During his whole life he had no right to write a prescription, and yet he revolutionized our medical science. When he wished to introduce his anti-anthrax vaccination, he had the greatest difficulties to contend with. This was drastically pointed out by one of his coadjutors, who said: Every one awaited, with thrilling and, perhaps, malicious expectation, the moment when the total failure of Pasteur would be clearly demonstrated by the dissections made." It was, therefore, not without significance that this telegram made allusion to Pasteur. Not only Vallée, but also Roux, the director of the Pasteur Institute in Paris, had stated that bovovaccine fulfils every requirement of a preventive remedy, that it is absolutely efficacious, and at the same time innocuous. This scientific confirmation of the fact that we have here a remedy against tubercle in cattle does not stand alone. It is also confirmed by the fact that far more than 100,000 units of my bovovaccine have been used in actual practice; these figures speak for themselves.

I should not like to miss this opportunity of alluding to the names of some gentlemen who have taken a prominent part in introducing bovovaccine into practical agriculture. First among these, I may mention Prince Louis of Bavaria, who, for the last three years, has had every one of the newly-born calves on his Hungarian estates vaccinated with bovovaccine by Dr. Strelinger. At a very early stage the question was practically taken up by Count Schwerin at Göhren, and Count Wolfshagen, in Mecklenburg; also by the bailiffs of Archduke Frederick of Austria, and by Prince Fürstenberg. I could also quote names in Belgium, Holland, and Russia; experiments on a large scale have also been carried on in Prussia and other parts of Germany. These are private enterprises; as to State enterprise, the best organization for practical bovovaccination exists in the Grand Duchy of Hesse, where Dr. Lorenz, under the direct patronage of the Government, conducts operations under model conditions, just as vaccination against small-pox is carried on by us.

This will show how natural is the conclusion that the time for testing the effects of bovovaccine is over. It is already an established fact; just as, eleven years ago, the scientific testing of my anti-diphtheria serum came

to an end, and its practical value was established. From a practical point of view, there will be nothing new learned about bovovaccine, though scientific institutions are working away with it, just as they have been working away for the last eleven years with the anti-diphtheria serum, and have made no great progress. I have to mention this, for I find that just those directors of institutions and theoretical professors, who seemingly have no call to create anything useful in therapeutics themselves, are the very people who postpone the recognition of other people's successful efforts till the Greek Kalends, or, at least, until they themselves come forward with some so-called improvement on them.

I have, however, something to say calculated to damp enthusiasts on the subject of the prevention of tuberculosis by inoculation. My expectations of the rapidity of the extinction of cattle tuberculosis by bovovaccination are much more modest than those of the Belgian official veterinary surgeons, who, after tests made with favorable results by a commission, published their opinion in the daily papers to the effect that in a very few years cattle tuberculosis would be quite stamped out by means of bovovaccination. According to my own experiences, I am not so optimistic, and I certainly never have given reason to indulge in such illusory hopes. I now give expression to my opinion that it would be a fatal error to believe that every young calf inoculated with bovovaccine will develop into a perfectly sound cow, and give milk perfectly free from germs. This will not be the case where the inoculation is made in a herd already infected with tuberculosis, and where the calves are not free from it at the time. It is impossible to prove with certainty whether an animal is already infected or not, and I have learned by experience that animals belonging to a diseased herd, and not inoculated with bovovaccine till they are a few years old, occasionally show a redevelopment of the disease at the time of calving; this is then erroneously looked upon as a failure of bovovaccine. I would consequently call your attention to the fact that whereas I would never seek to prevent the inoculation of an animal already infected with tuberculosis, as it can never do any harm, but only good, yet my bovovaccination is not a cure, but a preventive against future infection. That does not by any means preclude a beneficial effect of the inoculation on animals already infected. I could mention thousands of examples of this, but it must not be relied on; and it would be most imprudent of me, were I to make promises here to practical agriculturists like yourselves, which might not be fulfilled. I prefer, therefore, to draw your attention beforehand to such contingencies, which are not to be looked upon as a failure of bovovaccination, but as an error in the selection of suitable animals and their treatment.

These seeming failures which I have touched upon do not detract from the recognised success of bovovaccination in practice, and I believe that it will now stand on its own footing. I could very well leave the matter in the hands of other people, and turn my attention to other matters, if it were not that I am compelled to procure the means of pursuing fresh researches in tubercular-therapeutics with the object of combating human disease and human misery. And this brings me to the new means which I hope to find for combating of consumption in human beings, and to which I alluded at the International Congress for the Combating of Consumption in Paris.

In Paris I stated plainly that any attempt to stamp out consumption by means of bovovaccination, could not be recommended. I, at least,

would undertake no responsibility for the introduction of living tubercle bacilli into the veins of a little child for the purpose of preventing consumption. On the other hand, however, I see no objection to vaccinating children with a substance devoid of propagating tubercle bacilli, which has proved useful in the case of subcutaneous injection in animals. At the close of my lecture, I shall give some details regarding a vaccine of this sort which I have named "Tuberculase"—details which have a direct bearing on cattle-breeding and milk producing.

"Tuberculase" vaccine seems to me to be a very useful supplement to bovovaccination; for this last is only intended for very young calves, so that even under the most favorable circumstances, some years must elapse before cows quite free from tubercle are at our disposal for the supply of pure milk for infants' food.

In order to arrive at our goal more quickly, old cattle and the milch cows, which are still healthy, ought to be vaccinated; but the present method, however, of injecting living virus into the veins is not without danger, as the same dose of bovovaccine, which is quite harmless to new-born calves, often produces acute œdema of the lungs in older animals, and kills them. Bovovaccine, which, as you are aware, contains living tubercle bacilli, is injected under the skin. There is not so much danger of a fatal effect, but success is more uncertain; for a great part of the vaccine remains under the skin, and produces a local tubercular disease which militates against successful immunity. Above all, the subcutaneous injection of bovovaccine into milch cows is a serious matter, because living tubercle bacilli can find their way from the local seat of the disease into the circulation, and so into the milk. Therefore, in answer to the many inquiries of dairymen, who make a speciality of children's milk, as to whether they should not bovovaccinate their milk cows, I am obliged to answer in the negative, or with the greatest possible reserve.

At the time of my lecture in Paris, I was already in possession of the "tuberculase" preparation I then alluded to as obviating the danger of the transmission of living tubercle germs into the milk; it is free from living virus, whilst retaining its power of rendering cattle immune. This preparation also has to be injected into the veins, and its production is so troublesome and expensive, and the period in which it keeps good so short, that in its practical employment will be great difficulties.

The hope I expressed in Paris that the efforts made to improve the method of production, and the practicability of this remedy would be successful, has been fulfilled by the discovery of a new method of preserving the immunizing effect of the tubercle bacilli, and simultaneously suspending their animation. The "tuberculase" obtained by this method is a semi-fluid wax-like preparation, is fairly easily transportable, and not so costly in production as to prevent its adoption in practical agriculture.

"Tuberculase" requires to be administered, not only once or twice, but frequently during a period of from two to four weeks; no technical skill is required for the subcutaneous injection, nor does it necessitate the presence of a veterinary surgeon; consequently the cost of administering "tuberculase" is not greater, but rather less than bovovaccine.

I have not only treated cows free from tuberculosis with "tuberculase." but also cows which, although healthy in appearance, yielded virulent tubercle bacilli in their milk. After a few weeks' treatment, I observed

that the tubercle bacilli disappeared from the milk. These observations open up a hopeful prospect for the employment of "tuberculase" in combating consumption in human beings.

I must make special mention of the fact that I have not experimented on tuberculous cattle, whose condition in any way approached that of a human being suffering from tubercular consumption, and that consequently I have no scientific basis for the assumption that "tuberculase" may be a suitable remedy against consumption in human beings. I did not speak in Paris of a curative remedy for consumption, which had already developed, but of a preventive remedy which, by early administration to young people, should prove a protecting means against consumption, and in any case have such an effect on any consumptive centre that self-healing would be promoted and new infection kept away.

I intend to hold to my programme announced in Paris of not making my new remedy for consumption publicly known till the autumn of this year, so that it is absolutely useless for doctors or laymen to beg me, either by telegram, by letter, or in person, to make an exception in their case, and let them have some of it for consumptive patients. My experiences have made me more than ever resolve not to let the remedy go further than those specialists in the investigation of tuberculosis, who are already acquainted with my work in this direction.

Gentlemen, these remarks which I have tried to make as plain and impartial as possible, hold out no hopes which, in my opinion, may not be fulfilled in a short time. What I have said to you I have in such a manner said that it will still be true a hundred years hence; and I hope that the realization of what I have suggested may not be very long delayed. What I still have to say to you is about something else.

Those of you who remember a lecture I held in Vienna on 12th March, 1902, are aware that one of the chief problems I am working on is the obtaining of milk from cows which have been made immune from tuberculosis in a particular manner; this milk, in its turn, is to transmit the immunity to the infants fed with it. It is a great pleasure to be able to inform you that I am getting nearer and nearer to this goal. It is my duty, however, to add that years must elapse before the process can be made public. To illustrate this necessity, I may tell you that it took four years to bring a certain animal into the condition in which I could obtain positive results from its milk; then another period followed which yielded only negative results. My stand-point is that a result once attained can be regularly attained again by minutely studying and recognising the conditions which governed the first success. This was my starting point in previous investigations, and will continue to be so. It will explain the confidence with which I venture to regard the future—a confidence so great that I do not hesitate to express it in public.

This immunifying milk, then, is a matter for the future; but there is something else which can be realized now. If you agree with me in what I have said about the wholesome feeding of infants, I think we must be consistent, and not shrink from any conflict when so much is at stake. Whoever is thoroughly convinced of the importance of feeding infants with milk which supplies tissue-forming substances in their natural state, or as near it as possible, cannot do otherwise than express this opinion openly, without consideration of person, and try to get it carried out, as I myself do. In this struggle against the heating of infants' milk, I

seemed formerly to stand alone. I am glad that this is no longer the case, and that many other independent investigators, like myself, adopt the motto which I have followed for years in clearing away obsolete ideas:—"Nich ja aber, sondern "na also" (not "Yes, but," but "Well, then").

FARM BUILDINGS—ANCIENT AND MODERN.

One of the most evident signs of prosperity on a farm is fresh paint on the dwelling and sheds. For this, of course, sheds that are worth

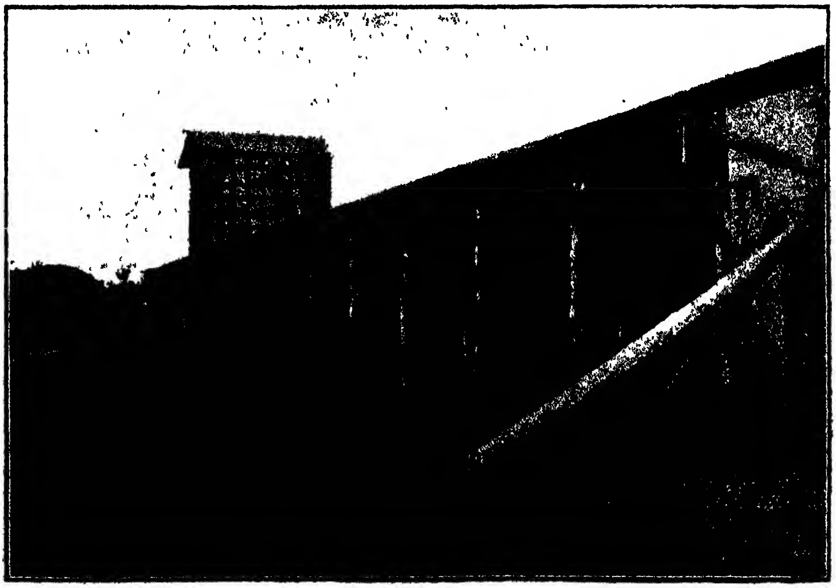
GENERAL VIEW OF PRESENT BUILDINGS.

painting are required, so that it may equally be taken as a sign of success where well designed and substantial buildings are to be seen. The one illustration shows a shed or stable, somewhat typical of the Mallee district—at any rate, in the early stages of settlement—a structure which, from all points of view, is just what is should not be. The farm, passing into the hands of a progressive and up-to-date man, has now been equipped with good stables, suitable for the comfort and health of the horses, with roomy and substantial sheds and barns, and with a silo. These may all be seen in the other illustrations. The silo, having previously been filled with chaffed green oaten hay, is now being emptied, and the silage is readily eaten by the sheep on the farm. Further improvements, the enlargement of an excavated earthen tank of some 2,000 cubic yards capacity, the erection of a windmill and elevated tank, and the laying down of pipes to irrigate an acre or two in close proximity to the silo, are in progress. The profit from

good sheds for storing fodder, and particularly for the efficient preservation of implements, is far above the interest on the outlay for the construction.

THE OLD STABLES.

Good stables, properly ventilated, but warm, clean, and kept so, save their cost in a short time, not only in the lengthened life of the working



THE NEW BUILDINGS.

stock, but in the greater amount of work which can be got out of them each day. Similar remarks apply with equal force to milking shed and

yards, and to piggeries. Now, while seasons are good and money plentiful, the farmer should look over his yards and buildings, do away with all makeshift erections, and put up structures of which he may be justly proud, and from which he will reap a substantial benefit.

A.S.K.

CHECKING LOSSES AT BUTTER FACTORIES.

R. Crowe, Superintendent of Exports.

In compliance with instructions from Dr. Cherry, Director of Agriculture, a few experiments were made last season to ascertain the amount of waste encountered in ordinary practice at our butter factories. For this purpose a number of factories were selected in each district, but when the first one had been visited, it was found that there was more urgent work requiring attention. The data secured from the four factories investigated should serve as a standard for future work, especially in the spring and summer months.

In order to secure full details, a programme of the various checks to be made was drawn up for adoption at each factory, so that records capable of comparison would be obtained. The time of the year was favorable to the securing of best results, as the output was well within the capacity of factory plants. This factor should always be remembered when comparing summer returns with flush supplies; and enable directors of factories to readily measure their losses through lack of refrigerating power, or false economy by sparing the refrigerator.

Mr. Archer carried out the tests at factories Nos. 1, 2, and 3, and Mr. Carroll at factory No. 4. Their respective reports are attached, and from those it will be seen that excellent records have been established, especially at two of the factories. The other two also show satisfactory results, and the records indicate the degree of proficiency reached in avoiding losses. It is recognised that all the butter cannot be absolutely secured; those showing the minimum waste may be regarded as a standard of efficiency for the guidance of all managers.

Factory No. 1.

All the supply at this factory is from the private separator source. Most of it is delivered three times a week, practically none daily.

It will be noted that the acidity of the cream was between .47 and .51 per cent.; temperature of cream when churned, .53 to .54 per cent.; percentage of fat in butter-milk, from .1 to .21 per cent. In the three days, 3,313 lbs. of butter were made, and 7 lbs. of fat, or .21 per cent., lost. So far as the experiments have gone, there is a greater loss in the mixed cream factories than the milk supply, and this is a matter that should have further investigation, also where the cream is cooled and kept in separate cans until churned. At the factories where these experiments have been conducted, the cream is cooled and run into vats until churned. The depth to which the churn is filled does not appear to affect the churning

so long as the work is done intelligently, the speed varied a little according to the circumstances, and the cream thinned, if necessary, to insure concussion.

This factory is well managed, as the results show. The manager was very much interested in the experiments, and wished for an opportunity to go further into the matter at a later period. Testing cream is conducted by weight, according to instructions given by me at a former visit, and the over-run is averaged and balanced up every day.

FACTORY No. 2.

The supply to this factory is partly mixed cream, and partly from milk separated at the factory and creameries. This was all mixed in the vats after cooling, so that it was not possible to get at the amount made from either source separately.

It will be noted that on the first day the acidity was .47, temperature when churned 60 degrees, test of butter-milk, averaged .16, total fat lost 8.4 lbs., or .43 per cent. of the total; while on the third day, with a lower acidity, viz., 43 per cent., but a lower temperature also (56 degrees), the butter-milk tested .04 and .05, the fat lost was 1.87 lbs., or .138 per cent. of the total.

There must be great loss at this factory at times in the summer, as, owing to insufficient refrigerating power, cream was often churned as high as ·68 degrees. A stronger refrigerator is being installed for the next season, however, so that the loss due to high temperature will be reduced. The churns were driven at a high rate of speed, but that was caused through having to drive the shafting quicker to get more power out of the dynamo. A new dynamo is being installed, and the speed will be reduced.

The results of these experiments would tend to show that temperature had the greatest influence on the loss of fat in the butter-milk, and also at the time of churning. If these experiments could be continued in the spring time, very great benefit should accrue therefrom. As it is, much interesting data was obtained. I cannot see that any fault could be found in the management of this factory. except that due to insufficient refrigeration, unless it is that the private separator cream should be made separately, but against that is the fact that a more uniform butter is made by mixing the two.

FACTORY, No. 3.

This factory treats milk entirely separated at the factory, and its own creameries, consequently a more regular system of management is possible. The advantage of this is apparent in the very low percentage of loss in butter-milk, being on the average only .022 per cent. of the total fat.

So far I have not found a factory where the cream has been churned at a low percentage of acidity. This factory was only churning every second day, so the experiments were not so full as could be desired. The manager was very much interested, and wished to be allowed to assist in the prosecution of further investigations later.

FACTORY No. 4.

There is no private cream received at this factory, the sources of supply being the company's own creameries. As a result of this system, the

work could be carried out with great regularity. The tabulated record shows that in a well-managed factory, little or no waste takes place. For the total amount of butter manufactured during the period of experiment (17th to 24th March), 3,150 lbs., a waste in churning of only 2 lbs. occurred. This amount represents .063 of the total amount produced, and must be considered a very satisfactory result. It will be noticed that the acidity of the cream never got beyond .42 per cent., and was never less than .40 per cent. at the time of churning. This variation of acidity did not seem to have any appreciable effect on the amount of butter lost in the butter-milk, or did the extent to which the churn was filled affect the cleanliness of the churning.

The whole work of the factory, separating, cooling and ripening of cream, churning, butter-making, and testing, is carried out with the greatest care and attention, every process of the manufacture being under the personal supervision of the manager. The application of common sense and sound practical knowledge is responsible for the splendid uniformity of the butter produced at this factory, and amongst the employés is found a genuine interest in the company's welfare.

Results of Experiments.

Tests.	Averages during period of investigation.				
	Factory No. 1.	Factory No. 2.	Factory No. 3.	Factory No. 4.	Average of Averages.
Temperature of cream on arrival	66·6	67·3	60	74	66·975
Temperature cooled to ..	53·0	59·3	...	48·8	53·7
Temperature of cream-room	55·0	60·0	58	50·6	55·9
Acidity of cream on arrival	·47 per cent.	·373	...	·388	0·41
Acidity in morning ...	·486 per cent.	·47	·48	·406	0·46
Temperature of cream-room in morning ...	53 deg.	55·6	57	56 6	55·5
Temperature in vat ...	53	58	54	52·8	54·45
Temperature when churned	54·6	58·3	54	57·2	56
Temperature of butter milk	56	...	..	55·6	55·8
Amount of cream daily ...	2,285 lbs.	...	..	1,230	1757·5
Amount of butter made ...	1,104	1,866	1,570	630	1292·5
Amount of fat	...	...	1,300	...	...
Percentage of overrun (actual)	17	20	20·77	20	19·4
Test of buttermilk ...	·156	·09	·042	·065	·0875
Percentage of butter fat lost	·22 per cent.	·23	·022	·06	·133
To what extent churn filled	½	½	¾	¾	¾
Speed of churn, revolutions per minute ...	50	54	41	35	45
Speed of churn, feet per minute	600	610	475	420	526
Per cent. contents other than butter fat by flask	...	16·6	17¼	16½	16·78
Moisture by evaporation	...	13½	13½	...	13½
Per cent. of salt by test ...	1·99	1·65	2·15	2·18	1·99
Time cream took to break	23 min.	24 min.	22 min.	31 min.	25 min.

SLUGS.

C. French, F.L.S., F.E.S., Government Entomologist.

Slugs belong to a group of animals known as Mollusca, and may be broadly divided into the shell-bearers and the naked mollusks. The life history of the native species of the latter is but little known, and is now being studied by specialists.

The large speckled garden slug and some other kinds, together with the common garden snail, have been introduced into Victoria through the agency of pot-grown plants sent here in the early days of the colony in Wardian cases, also in the soil in which some of these plants were packed.

The life-history of the slug is a somewhat simple one, the eggs being laid in batches, and as many as five or six hundred eggs may be laid in a season. The eggs are small round bodies, with a skin as soft as parchment. According to some observers, the vitality of these tiny eggs is almost incredible; they may be squeezed nearly flat, and still survive. In Victoria, the eggs of the slug are deposited nearly the whole year round, hence the enormous numbers which occur in seasons favorable to hatching, especially in land of a heavy nature and irregular surface. The eggs are not hatched all at one time; according to Mr. Wotton, who has studied the various British species, several days frequently intervene, the average period being about 60 days (in England), but is probably much less in our warmer and more congenial climate. Extremes of any kind are against the chances of rapid propagation.

When the slugs are hatched, they begin to crawl, and, as we know to our cost, soon commence to eat freely. In England, according to the best authorities, full growth is attained about the middle of the second year, and nearly all die at the end of that year or the beginning of the next. In some species self-fertilization appears, according to Mr. Wotton and others, to be an established fact.

With regard to the Victorian species, of which there are many, especially in forest lands, it may be mentioned that no matter how short a period has elapsed since fires have passed through the country, the small black slugs may be found almost anywhere. On land which has been out of cultivation for years—30 years, to my own knowledge—when a rail is lifted or a piece of cow-dung turned over, slugs are always to be found, but not in such numbers as in gardens. This points to the fact that birds and other agencies have united in keeping the slug pest in partial subjection. In grass lands particularly, vast numbers of slugs are annually destroyed by magpies, crows, mud-larks, and other insect-eating birds.

Slugs are mostly nocturnal in their habits, but will also feed in the day time. It is, however, at night and just before daybreak that both the slugs and snails do the most damage to vegetation. The common snail, excepting after a shower of rain in summer time, usually makes itself scarce when daylight appears.

The slug question is one well worthy of much attention, as it is most discouraging to lovers of horticulture, and to those growing vegetables,

either for private use or for sale, to find their efforts sometimes rendered useless owing to the depredations of both slugs and snails.

Numerous articles for the prevention and destruction of slugs have been published, but the advice here given has been mostly gained by a long personal experience.

PREVENTION AND REMEDIES.

See that the lands are properly drained, and as few hiding places as possible left in which the slugs can secrete themselves. Keep the land as well stirred as possible, as this will be a sure way of destroying vast quantities, both old and young. Do not use stable manure, except for mulching, as there are now suitable artificial manures, which, whilst fertilizing the soil, do not afford shelter for slugs. When digging land, especially heavy soil, give a good dressing of lime, as slugs dislike lime in any form whatever.

The two most reliable remedies are, without doubt, lime and tobacco. When lime is used, it should be as fresh as possible, and renewed after rain. For young slugs, which are hidden in the ground and are difficult to get at, lime water is an excellent thing to use. It will kill off large numbers of the pests. Watering the infested parts with a weak solution of ammonia, prepared by dissolving solid ammonia in water, has been tried with good results. Lime placed in rings around the plants is also a good remedy, but in doing this, care should be taken that some lime be laid close to, but not touching the plant, otherwise if this precaution be not taken, the small slugs will come up within the lime zone and eat the plant before daylight reveals the damage done.

Tobacco is best used in dust form. This substance appears to paralyze the slugs which, together with snails, may frequently be found either dead or helpless in the dust of the tobacco; they cannot stand the substance in any form, but although they will sometimes cross leaves and even stalks of refuse tobacco, the dust appears to be a barrier to their progress.

Slugs show a decided preference for food of their own kind. If a number of slugs are killed, they are greedily eaten by their comrades, who will not leave their meal until the last particle is gone. Trapping slugs is also a good plan to adopt. The best method is to place cabbage leaves, which have been gently fried in a little grease, here and there among the plants. Before retiring for the night, go out with a lamp and shake the leaves into a bucket containing strong salt or lime-water.

Spraying the food with Paris green is also a good method, and so is the laying of beef or mutton bones about the garden, as bones have a great attraction for slugs. Soot is not relished by them, and will often prove of great use both as a deterrent and as a fertilizer. The well-known method of hunting for slugs and snails by lamp light is too well known to need explaining here, and the process is not a verv agreeable one.

Another cheap and effectual way of dealing with these pests is to place circles of carbolized saw-dust around the plants, as they will not cross the saw-dust, or go near to where it is; it has the additional merit of being fairly permanent, frequent renewal being unnecessary.

Zinc bands or circles are also useful, but when rain comes and covers them with dirt, the slugs will then crawl up the outside of the bands as easily as possible.

The keeping of poultry, gulls, and other birds in infested places, is to be commended, as it is astounding what a number of slugs some of these birds can devour. Although young ducks are useful helps in this way, they are too fond of peas and many other vegetables to be trusted in most gardens. There are various articles sold for the purpose of destroying slugs, but these are, in most cases, too costly for growers on a large scale.

A NEW POTATO.

Alfred J. Ewart, D.Sc., Ph.D., F.L.S., Government Botanist.

In the May number of the *Agricultural Journal of the Cape of Good Hope* (Vol. XXVIII., page 618), mention is made of a new potato (*Solanum Commersonii*), whose good qualities have been very extensively advertised in France and abroad by M. Labergerie. The yield of the potato is given as from 5 to 20 tons per acre, without any cultivation after the first year beyond a little hoeing, and the labour involved in digging up the crop. The plants are also stated to do best on wet marshy soils; to grow well between trees; to stand frost; to have a high yield of starch; and to be immune to disease. It has been suggested that it will prove particularly valuable if introduced into Ireland.

Attracted by these statements, the enterprising Engineer of the Birmingham Drainage Farm, which is about 8 square miles in extent, procured samples of this potato at an extremely high price from its exploiter, and submitted them to me for testing. Samples were grown in various situations on agricultural land, and at the Birmingham Botanical Gardens, and the results were uniformly highly unfavorable. The tubers were small, and had a very unpleasant bitter taste, rendering them useless as a table vegetable, although pigs will eat them, especially after they have been boiled. The yield was also small, in some cases being less than the amount first planted, while the tubers were very much less starchy than the ordinary potato. The plant forms long runners, which creep underground to a distance of 1 or 2 yards in a single season in rich wet soil, and these make the plant very difficult to eradicate when once it has established itself. The smallest portion of these runners, if it includes a scale-leaf, or node, will grow when left in the soil.

Altogether, the potato proved to be utterly unsuited for ordinary cultivation, and should its fame reach agriculturists in Victoria, they will be well-advised to fight shy of it. It is worthy of note that this much advertised potato is not a new one, but is an introduction from Brazil, which has long been known at Kew. Further, it does not stand frost as M. Labergerie states, although naturally mere surface frost will not kill tubers below the ground unless it reaches them.

It remains to be seen whether the sweet variety with violet pulp, which M. Labergerie has evolved in response to complaints as to the bitter taste of the original tubers, has any more real value and tangible existence than the remarkable horticultural wonders so often produced, on paper, in America. So far as can be seen at present, the only possible use for

this potato would be to plant on swampy waste ground, over which pigs were allowed to roam, and root out the tubers, but even here it would be a weed yielding little return, and preventing the utilization of land, which when drained would be put to better use. Bearing in mind the fact that several introduced Solanums are becoming troublesome weeds, and that another one (*Solanum heterandum*) has recently appeared in this State, the introduction of yet another in the guise of a cultivated potato, is hardly advisable.

It is possible that by crossing with the ordinary potato interesting and possibly useful varieties may be obtained, but we have no evidence that this has yet been done, and such work involves a considerable expenditure of time and money. As matters are at present, M. Labergerie's tubers do not deserve in any way the extravagant praise bestowed upon them.

ADVANTAGES OF THE SILO.

Even in the irrigation districts where green feed is available throughout the year, the silo is proving indispensable to the dairy farmer. Its value in storing the surplus production of the warm season to tide over the less productive time of winter is very great. Mr. H. Jacob, of Mildura, writes:—

"I have now all the maize in the silo. I also put in some green barley. The silage has turned out better feed than I expected, as the maize was rather dry, and the cattle ate the cobs only, wasting the rest. Now all of it has a sweet smell, and the cows are very fond of it, and are milking well. I have no waste; the cows eat up every scrap. If the maize had been left on the ground, the frost and rain would, by now, have spoilt the lot. So I think that, even under irrigation, with a regular supply of green feed, a silo is a necessity.

"I find the silo and elevator very useful for chaff; there is no bagging or clearing up, the only work being to feed the chaff-cutter. One man, feeding and driving the horses, can cut enough in an hour to last a day."

A.S.K.

BUILDING UP THE HERD.

"Only about six times during the past two years has our weekly herd test fallen below 4.0, whereas it used to get down to 3.4. Even then there was no more milk—actually less; not only so, but the cows we now have for sale are eagerly sought after by previous buyers in our own locality. This is a good testimony to a system of culling by butter production, and selling cows by what they have actually done. We also send out each year a few young bulls from picked cows. Although we have not got up to the yields on many of the rich dairy farms, we are far above the average, and intend to plug along steadily."—Extract from letter from A. L. Galbraith and Sons, Tyers, Traralgon.

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THE ELEMENTS OF ANIMAL PHYSIOLOGY.

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CHAPTER I.

The Essentials of Life.

The best way to understand the working of a complex piece of machinery is to examine the earliest and simplest types. If we know, for instance, the principles on which Stephenson's *Rocket* was constructed we are in a fair way to understand the working of a modern locomotive. The same may be said of living things. The animals we designate by the term *mammalia* are the most complex and the most perfect of all living things, at least on this planet, and, therefore, before we can hope to understand what is known of the workings of their bodies we must first of all study the earlier and simpler types of life. Now, a frog is lower in the scale of life than a horse, but it is still high compared with the fish; whilst far below the fish we must place the worm. In this way we can go down the long ladder of living things until we come to a point where animals and vegetables meet, and below which there is no other form of life possible. This lowest, simplest, and oldest type of living thing is the SINGLE CELL.

There are very many varieties of such lowly developed creatures. For instance, the micro-organisms which enter our bodies and cause disease; some of these are plants, for instance, the bacteria of consumption, lock-jaw, and diphtheria; some are animals, such as the germ of malarial fever. Yeast belongs to this lowest class of life, and is looked on as a plant; a teaspoonful of yeast is really a vast horde of individuals, each composed of a single cell; also the microscopic creatures which may be seen to sparkle in the sea at night when the water is disturbed—these latter belong to the animal kingdom. But all these living things at the bottom of the ladder have this in common that each individual is composed of a single cell.

Structure of the Cell.

A cell consists of a body called the NUCLEUS, enclosed in a layer of substance called the PROTOPLASM. In most, if not all, cases, the protoplasm is lined on the outside by a thin covering called the CELL WALL. The nucleus is always a small body, and it so happens that the layer of protoplasm covering the nucleus can never be very much deeper than the width of the nucleus; hence it is that most living cells can only be seen under the microscope, and some of them only when high powers of magnification are employed; a very few may be seen by the naked eye, but they are never more than a few millimetres* in length. In contrast to this limitation in size, we find that the shapes which living cells display are unlimited. But in all cases there is a nucleus, and beyond the nucleus there is a protoplasm, and, we may further add, beyond the protoplasm is a watery fluid, either fresh water, sea water, or some watery solution.†

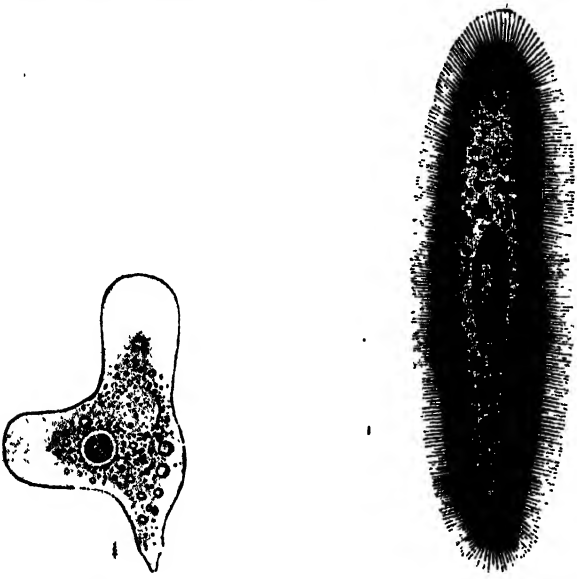


Fig. 1.—(*a*) *Amœba* (magnified). An animalcule found in stagnant water. The dark body is the *nucleus*, and beside it is a pale *pulsating vacuole*, which, by altering its shape, keeps the protoplasm in movement. (*b*) *Paramæcium* (magnified). An animalcule found in water in which hay has been soaked. It has a well-marked *nucleus*, and two *pulsating vacuoles*. All round are tiny protoplasmic feet (*cilia*), which, by rapid movement, can propel the cell in any direction. (After Verworn.)

Protoplasm is neither solid nor fluid, as we usually understand by these terms; it rather resembles unboiled white of egg in consistency. When viewed under the microscope it presents a dotted appearance, as if delicate strands of firmer material were running in all directions through it, forming a meshwork. Here and there in the protoplasm are minute particles of substance which the cell is about to push outside, or is storing up for use as food. The nucleus is probably a little firmer than the protoplasm, but its structure is far more complex. In fact, a nucleus is an

* A millimetre = $\frac{1}{25}$th inch approximately.

† The term BIOPLASM will be used to denote both protoplasm and nuclear substance.

intricate mechanism rather than a simple substance, and it is in and around the nucleus that the greatest activities of the cell are manifest. Of the supreme importance of the nucleus many experiments give evidence. It has, for instance, been found possible in some of the larger single-celled creatures to tear off a portion of the protoplasm, and thus divide the cell into two parts, one with, and one without the nucleus. The unnucleated protoplasm continues to show some signs of life for a short time, but it has no power of repair or growth, and very soon dies. This is prettily shown with the *Polystomella,* a cell with a calcareous wall, which can be broken in the manner described. In the portion retaining the nucleus the

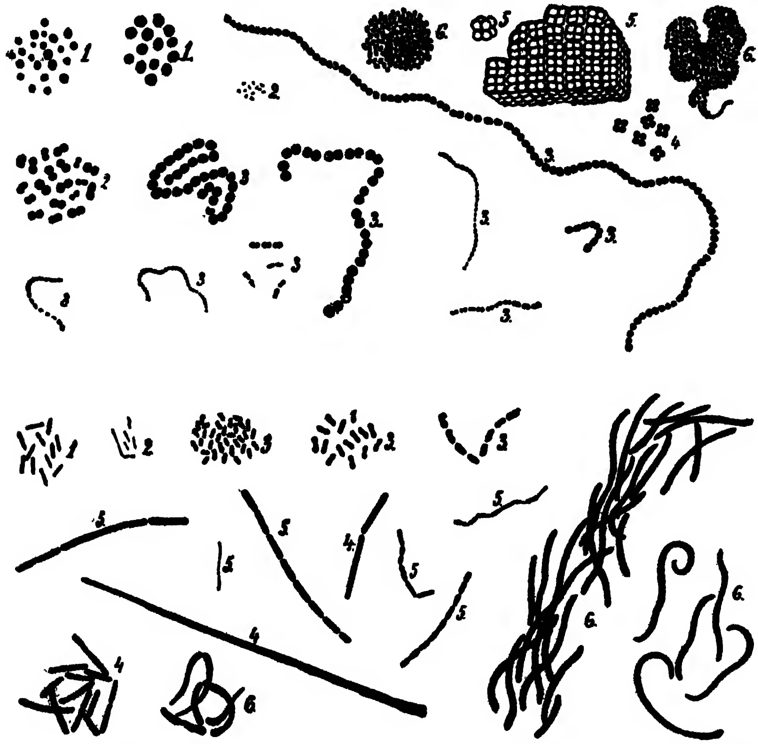


Fig. 2.—Illustrations of the manifold variety in size and form of different bacteria. (After P. Baumgarten.)

wound is speedily closed up with a new shell, and the cell's activities continue unabated; the unnucleated portion, however, goes rapidly to pieces, and is eaten up by other micro-organisms. We may lay it down then, as an all-important law in physiology, that, IF A CELL BE DIVIDED, THAT PORTION WHICH RETAINS THE NUCLEUS MAY LIVE, THAT PORTION WHICH IS CUT OFF FROM THE NUCLEUS MUST DIE.

Fundamental Characters of Life.

There are some characters common to all living things, both high and low, which may now be considered briefly:—

1. RENEWAL AND REPAIR.—It is essential to life that the different structures employed should be constantly renewed, not in large

portions at a time, but each part in a gradual manner. We are familiar with the mending and renewal of the parts of a machine, such as a bicycle; at one time a new tyre, at another a new spoke is added, until, as sometimes happens, no single part of the original structure is present. But if, instead of these parts being inserted complete and at separate times, the renewal was constantly being effected—if in every moment of the bicycle's existence each spoke and tube and screw was taking a minute amount of fresh material into itself, and throwing out a minute amount of old material, if the paint and rubber were not only replaced as soon as rubbed off, but were constantly being renewed in the same slow and continuous manner—

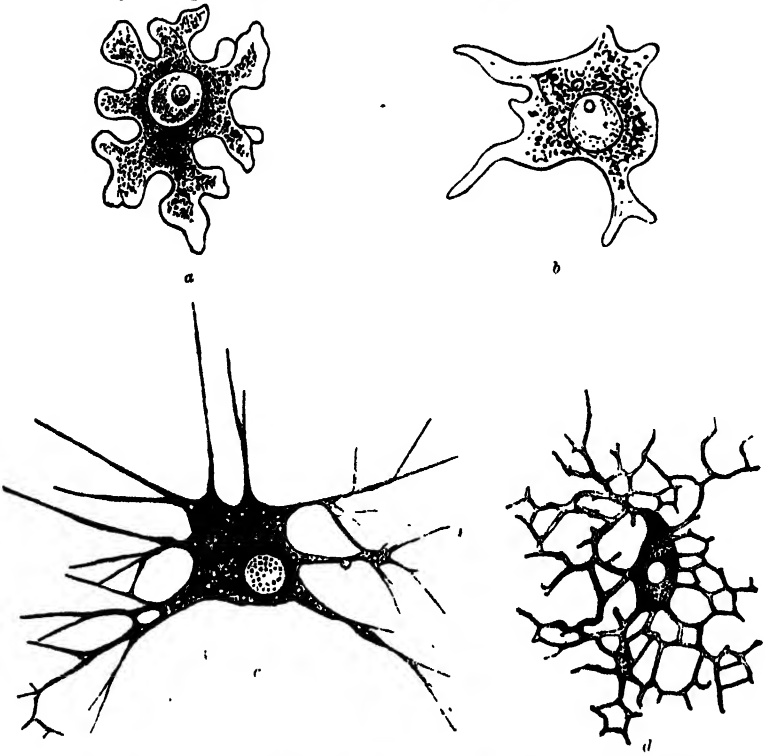


Fig. 3.—Showing four different types of motile cells. (*a*) Egg cell of a calcareous sponge; (*b*) blood cell of a crab; (*c*) a fresh water animalcule; (*d*) pigment cell from the tail of a tadpole. (After Verworn.)

we should have a better model of a living thing. Certain larger portions of the organism which have been lost by accident may be replaced. We have seen that the *Polystomella* can mend a gap in its shell; a lizard can grow a new tail, and, in the same way, a mammal can grow a new piece of skin after a cut or a burn. But there is a limit to this power of replacing a large portion of substance. We, for instance, if we lose a finger or an eye, cannot grow a new one, much less an arm or a leg. In fact, the higher an animal is developed the less power it has to make good such losses; one reason being that in the higher animals the parts lost are far more complex than analogous portions of lower animals, so that, unfortunately, repair is out of the question.

Now, to enable the animal to keep this renewal and repair in progress, it is necessary that it should take up fresh material, in the shape of FOOD, and to eject old material in the form of EXCRETIONS.

2. ABSORPTION OF ENERGY AND PERFORMANCE OF WORK.—Most animals move their bodies about, chiefly to obtain food or to escape from danger, and in doing so perform work. Even those single-

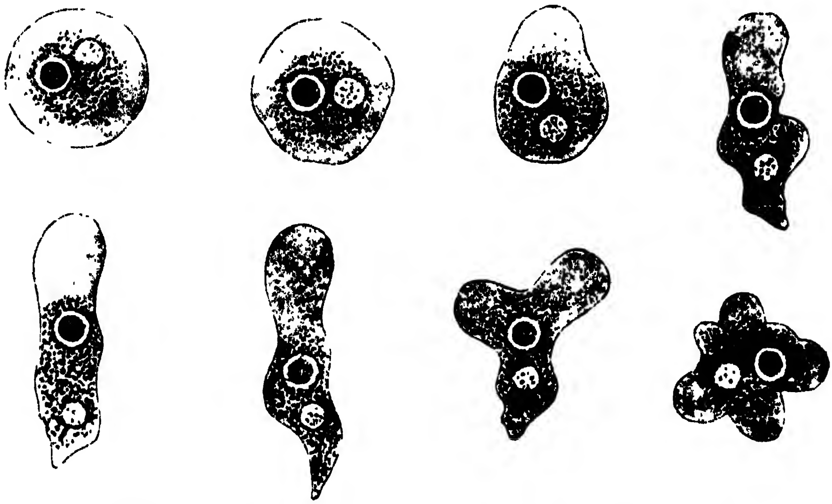


Fig 4.—*Amœba* in eight successive stages of movement. (After Verworn.)

celled organisms, which show no movement, such as yeast cells, perform work, for in these, as in all cells, the protoplasm is in continuous movement; other activities, too, such as the discarding of waste material and taking up of fresh, and the various chemical reaction, to be described later, are continually at work.

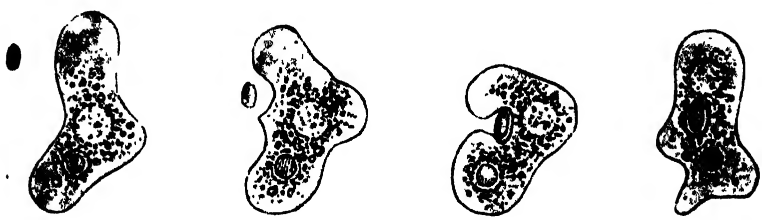
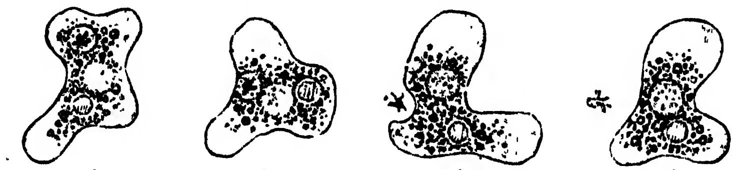


Fig. 5.—*Amœba* approaching and capturing a particle of food, in four successive stages. (After Verworn.)

Now, no work can be done unless energy is expended, and we have to consider whence the energy comes. We shall find that all the energy utilized by living things, both plant and animal, is derived from THE BREAKING DOWN OF COMPLEX UNSTABLE COMPOUNDS INTO SIMPLER AND MORE STABLE SUBSTANCES. For instance, the yeast plant takes up sugar, and splits it into alcohol and carbon dioxide. Now, experiment shows that the heat produced by burning a definite weight of sugar is greater than

the heat produced by burning that weight of alcohol, which would be derived from the sugar. The carbon dioxide cannot be burnt, it is at the bottom of the energy ladder. Now, this difference of heat between burning sugar and burning alcohol represents so much energy which the yeast plant can have at its disposal. Another instance is the lactic acid bacillus, which changes sugar into lactic acid. Here, too, if we burn some sugar and the corresponding weight of lactic acid, we find that the latter gives off less heat, and this difference means so much energy which the bacillus



A B C D

Fig. 6.—An *Amœba* in four successive stages of excretion of the undigested residue of food. (After Verworn.)

can use. But the quickest and one of the simplest methods of breaking down unstable bodies into stable, and so liberating energy is OXIDATION. A larval bee, for instance, eats sugar, but it is not content with a break-down into alcohol or lactic acid, it oxidizes the sugar completely into water and carbon dioxide, and thus gets all the energy possible. While, therefore, some plants and animals can live in the absence of oxygen, it is only the most lowly organized which can do so, as their energy requirements are small. Some plants can live with or without oxygen; a familiar

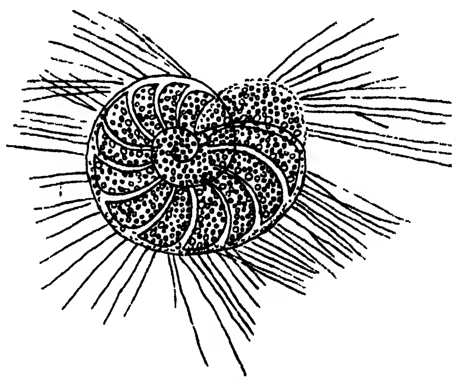


Fig. 7.—*Polystomella*, showing the shell and strands of protoplasm outside the shell. The nucleus is hidden by the shell. (After Schultze.)

example is *Mucor*, a mould which grows readily on jam. If *Mucor* be given oxygen it oxidizes the sugar to water and carbon dioxide, but if oxygen be denied it has to content itself with the same change which the yeast plant employs, that is, the splitting of sugar into alcohol and carbon dioxide, though much more sugar will have to be broken down to obtain a definite amount of energy than if oxidation were brought into play. All the higher plants and animals obtain most of their energy by oxidation, though non-oxidative changes can also be employed to a slight extent.

But all the energy obtained, whether due to oxidative or non-oxidative change, cannot be transformed into work. This is a well-known law in physics, and it tells us that only a fraction can be so utilized. Coal is a complex, unstable body, and when oxidized (burnt) gives out energy, but very few steam engines turn more than 15 per cent. of this energy into work, the rest appears as heat, which warms the machinery and escapes into the air. The living animal in the same way can only turn a fraction of the energy into work; in the case of the human body about 22 per cent. is so converted, the rest of the energy taking the form of heat, which warms the living substances and escapes. Hence it is that ALL LIVING THINGS PRODUCE HEAT, AND THE MORE WORK THEY DO THE GREATER IS THE HEAT PRODUCED.

We have seen that food is necessary for repair and renewal; we now see that food is also necessary to supply the complex bodies which will liberate energy. The excretions also contain not only the scrap-heap bodies due to repair, but also the degenerated remains of the food taken as fuel.

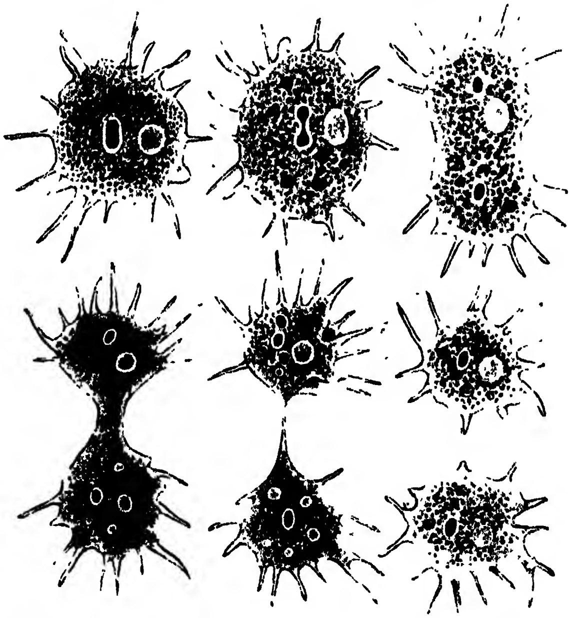


Fig. 8.—*Amœba* in six successive stages of division, showing the elongation and subsequent division of both protoplasm and nucleus, resulting in two *amœbæ*, each with a nucleus. (After Schulze.)

3. RESPONSE TO CHANGE AND SURROUNDINGS.—A child wishing to find out whether an object is living will prod the object with a stick, or make a loud noise, and then see whether the object moves. In physiological language, the child has applied a stimulus, and the object, if living, will respond to this stimulus. This change in a living animal produced by a change in its surroundings is a most important characteristic of life. The more highly developed an animal is the more able is it to detect changes in its surroundings, and the quicker and better can it respond. Now, this response to stimulus has always a certain character—it tends to preserve the life or the comfort of the living thing concerned.

A rabbit prodded with a stick will run away; a dog similarly treated may bite its tormentor; but both with the same object in view. Another feature of this response will be noted, namely, that the response is not limited only to the spot stimulated. This is observable with the lowest animals. Touch one of the tentacles of a sea-anemone, and all the tentacles are drawn in. Even in a single-celled animal a stimulus which irritates one only of its tiny projections of protoplasm may be followed by the cell shrinking and drawing in all its protoplasmic feet. There must be some means, therefore, by which one part of the organism can send messages to the other parts—this mechanism we shall deal with in another chapter.

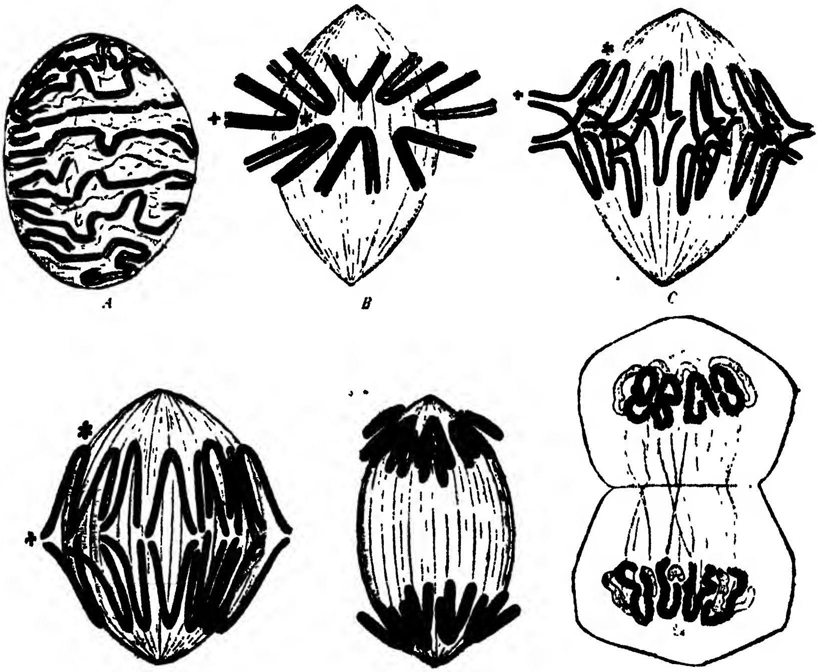


Fig. 9.—Showing the complicated structure of the nucleus and the changes it undergoes on division. (After Flemming.)

What changes in the environment are able to evoke a response from the cell?

(*a*) *Temperature Changes.*—If the temperature of the surroundings is lowered, the activities of the cell become sluggish—with rise of temperature a rise of activity occurs. But there is a limit to this response to warmth, for very soon the high temperature destroys the living substance, and causes death. In fact, no living cell can stand the temperature of boiling water, and most die at 125 degrees Fahrenheit. Heat high enough to injure living substance, if applied to any part of the living substance, acts as a powerful stimulus to that part, and causes a response from the whole organism.

(*b*) *Changes in Concentration of the Surrounding Fluid.*—The changes vary with the cell observed, and need not be described here, only it must

be noted that, just as with temperature, there is a limit. High concentrations will kill—witness the *Dead Sea*, and the preserving action of strong syrup; whilst too low concentrations tend to make the cell become waterlogged, and finally to burst.

(*c*) *Changes in Light*.—With most cells very strong light acts as an irritant, and often causes death; hence the disinfecting action of sunshine.

(*d*) *Electrical Changes*.—To all cells a sudden change in electrical condition (*i.e.*, a shock) acts as a stimulus, and may kill, if sufficiently great.

(*e*) *Chemical Changes*.—Sometimes we find that cells are attracted by some chemical substance, or have their activities heightened. Many cells move away from irritating chemical bodies. All substances which chemically injure living bioplasm act as stimuli.

(*f*) *Mechanical Changes*.—Alterations in vibration or pressure may call forth a response. Local pressure, if intense enough, always acts as a stimulus.

4. DEFENCE.—Living bioplasm is, as we have seen, readily disturbed or killed by changes in the surroundings, and all living things have living enemies. The lower in the scale living things are, the more readily and in greater number do they succumb to such changes and attacks, but in the lowest forms there is always some attempt at defence. Many single-celled animals clothe themselves with a hard shell (see Fig. 7); most living things capable of movement try to escape from injurious surroundings. It is probable that in all animals there is, in addition, a chemical response in the living bioplasm, by which antidotes are produced when the poison is derived from another living thing. This will be discussed more fully in the chapter on immunity.

5. GROWTH AND REPRODUCTION.—Most living things start life small, and grow larger; but all living things reproduce their species. A single cell may divide into two in the manner indicated in Figs. 8 and 9, or its bioplasm may break up into a large number of very small spores, each of which is capable of growing into an individual cell. There are many other forms of reproduction, but throughout the whole realm of life the law holds THAT EVERY LIVING INDIVIDUAL IS THE OFFSPRING OF ANOTHER INDIVIDUAL, AND THAT EVERY CELL HAS ARISEN FROM ANOTHER CELL. This is a very important principle, which has now a wide practical application. If a food-stuff (meat, milk, fruit, &c.) is heated to destroy all living germs, and then sealed in an air-tight vessel, no life can develop in it, and, in consequence, the food *keeps*. If any form of life—for instance, bacteria—should be found in such a packet, as would be evidenced by the putrefaction of its contents, we know that either the germs were not all destroyed at first, or that life has come in from without by means of a leak in the vessel wall.

6. MEMORY AND INTELLIGENCE.—A locomotive running into a snowdrift will rebound, and then charge the obstacle again; a second rebound will then take place, to be followed by another charge. This will go on until the steam is exhausted or turned off by the driver. But if a living cell moving about meets with an obstacle it may charge it once or twice in the same manner, yet, sooner or later, it alters its direction of attack, or simply tries to find a way round. This reaction, which has been called the method of TRIAL AND ERROR, implies the existence of MEMORY in the cell (*i.e.*, it can remember its failure), and also of INTELLIGENCE, for it tries a new way of getting over the difficulty.

Animals are marked off from plants by the possession of these faculties in a much greater degree. The higher in the scale of life an animal is the wider is its range of memory and intelligence. It is in mental characters that man is so far apart from the mammals nearest to him (chimpanzee, &c.); in other respects the differences are trivial.

TREE BUILDING.

Results of Systematic Work on the State Demonstration Grounds.

C. Bogue Luffmann, Principal, Burnley School of Horticulture and Small Farming.

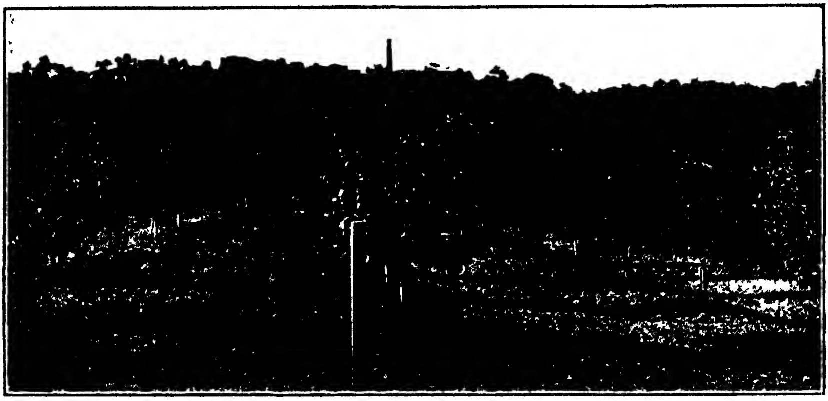
In 1902, or four years from the time of writing, six small areas were selected in as many parts of the State, with the object of showing how soil should be prepared and thrown into form; what species of trees

ROW OF TWO-YEAR-OLD APPLE TREES PLANTED ON BOLDLY RIDGED LAND.
Trunks heavily bandaged throughout summer. Difference between crown of planting line and centre furrow, about 16 inches.

should be selected; and how they should be pruned and cared for, in order to yield profitable returns. The nature of the preliminary, as well as the ordinary, routine work has already been set forth in this *Journal*, and it now remains to show how far the trees have progressed, and stand as a safe guide to those engaged in commercial orcharding.

It may be said at once that, taking the trees as a whole, they are fully twice the size of average four-year-old trees. But more important than this, they are very robust and broad based; open enough to secure light and fruit in every part; their general design renders them capable of the largest possible yields of fruit with the least possible strain, either physical or mechanical; they will prove very easy to prune and manage; being vital in every part, they will have the fullest powers of resisting both insects and disease; their shape and general condition is conducive to a long and profitable life.

The youngest trees selected for illustration are growing in the State demonstration orchard at Castlemaine. The soil is of the very poorest description, originally no more than 3 or 4 inches of broken shale, and resting on close, dry, and very uncongenial material. But, recognising

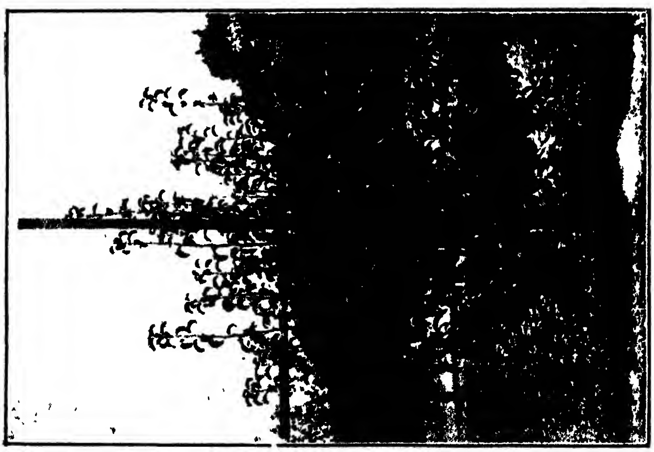


PEARS, PLUMS, AND APPLES, THREE YEARS PLANTED.

that a good man is of more importance than a good soil, it was decided to show what skill and industry may produce on a poor piece of land. Mr. C. H. Greensides, who owns and works the State orchard at Castlemaine, has shown a rare faculty for the work, though orcharding is not

ROW OF THREE-YEAR-OLD PEARS IN POOR, THIN, AND EXPOSED SOIL.

his profession, and I take this opportunity of stating that the orchardists of Victoria, and those of his own district in particular, may thank him for furnishing a safe and lasting example of soil and fruit tree management.



THREE-YEAR-OLD PEAR TREE.

Height: 8 ft. 4 in; diameter, 5 ft. 6 in.; trunk, 3 inches in diameter.

THREE-YEAR-OLD PLUM TREE.

Height, over 10 feet; diameter, over 8 feet, trunk, over 3 inches in diameter.

THREE-YEAR-OLD APPLE TREE.

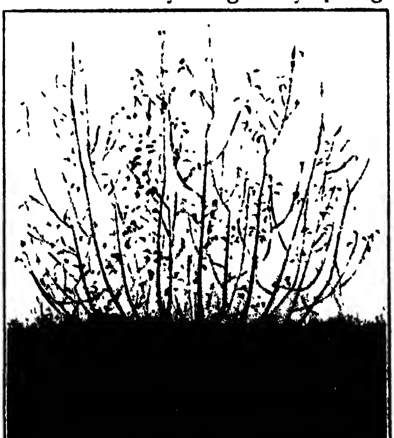
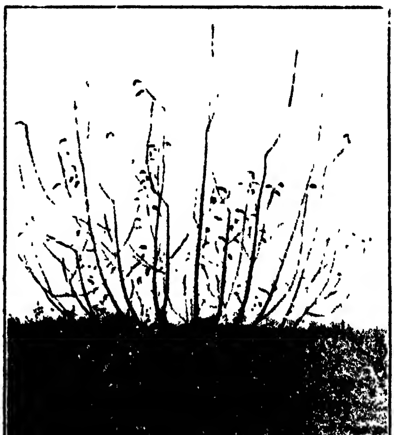
Height, 8 feet, diameter, 5 ft. 6 in.; trunk, 2¾ inches in diameter.

Excellent work has been done in all the State orchard blocks, but Castlemaine is placed first owing to its representing a very large area of the State, and the excellent results achieved under such hard conditions.


PEACH TREE IN DEMONSTRATION ORCHARD, RUTHERGLEN.
Unpruned and pruned.

Notable features in connexion with these orchards may be set out as follows :—

1. All trees were planted above the mean of the land. That is, the soil was boldly ridged by ploughing two, three, or four times on the

APPLE TREE IN DEMONSTRATION ORCHARD, RUTHERGLEN.
Unpruned and pruned.
Both this and the previous example are capable of bearing in every part, and as long as they live

same line, thus securing a deep mass of well drained and aerated soil at the time of planting. Actual mounds were in some instances secured by hand labour.

THREE VARIETIES OF SIX-YEAR-OLD APPLE TREES GROWN AT BURNLEY GARDENS.

All over 10 feet high and 9 feet wide ; perfect leaves and fruit from trunk upwards.

2. All trees were selected with trunks of a length proportionate to their strength, and the native bias and requirements of each sort. Thus,

MATURE PEACH TREE, DROUIN DEMONSTRATION ORCHARD.

Fruiting in all parts, but still too thick in the top. About two-thirds of the head wood calls for removal.

ROW OF PERFECTLY FORMED YOUNG PEACH TREES, DROUIN.

Fruiting wood equal in all parts; unpruned

peaches and apricots always have short trunks; strong pears, plums, and apples have trunks from 18 to 30 inches long, according to position;

whilst weak pears, plums, and apples have short trunks, not exceeding 1 foot or 15 inches.

3. A few heavy, as against fibrous, roots are chosen for all trees planted in ordinary dry and open country.

4. Trees which have not been subjected to summer pinching when in the nursery are always sought, straight rods being much more capable of yielding good trees than such as are during summer cut to a uniform height, regardless of their kind or vigour, or the class of country in which they are eventually to grow.

5. The trees were cut harder than is usual at the time of planting, both roots and heads being reduced to three or four stout stubs. In many cases the heads were cut off, owing to the existing head being too weak or otherwise faulty. In all cases these deheaded trees now furnish the best specimens. It is not always safe to cut the head from

MATURE APPLE TREE AT BURNLEY GARDENS.
Kept light in the extremities and thereby enabled to fruit evenly and regularly.

a faulty nursery tree, much depending on the vigour of the roots and stem, and its power of forcing and sending out buds on a line where the head is desired. As in all else, experience is wanted in this matter.

6. All trees were planted very shallow, the top roots being but an inch at most beneath the soil. Water was in all cases used to wash in and settle the soil about the roots.

7. Sackcloth bandages encased the stems from the time of planting. These were taken off occasionally and re-adjusted, so as to prevent any injury by their cutting into the bark or acting as ligatures. Trees with thick bandages are usually about double the size of such as go unbandaged. This applies more particularly to open and dry country.

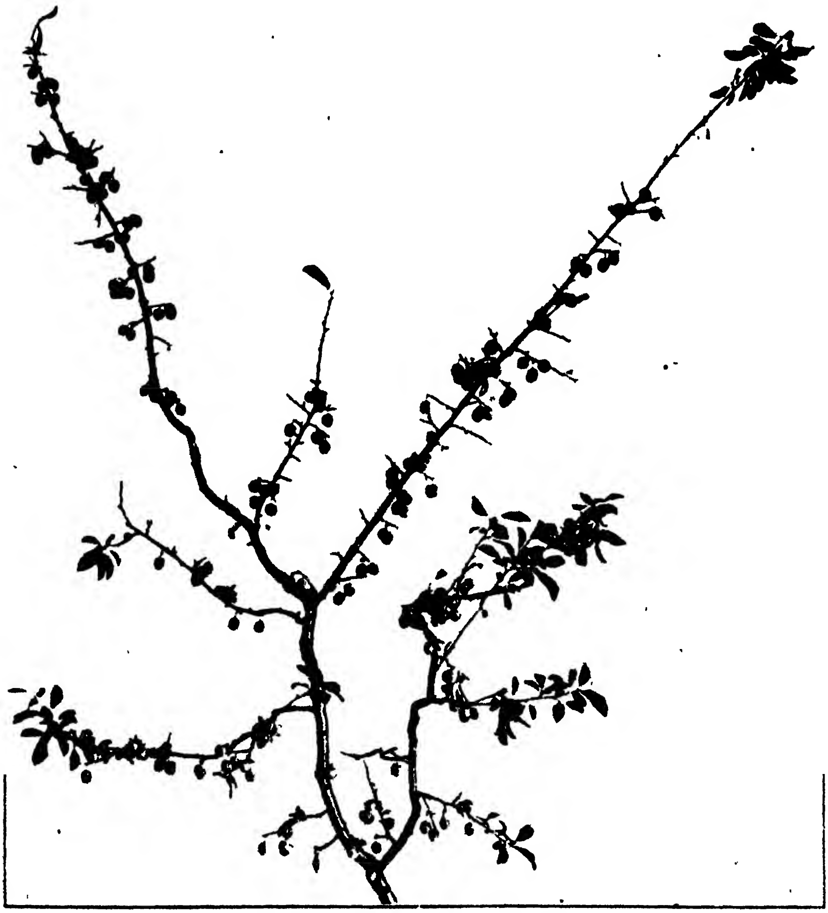
8. A manure or litter mulch was spread about each tree in spring. No water was available in summer.

9. Ploughing was almost entirely up to the trees, hand labour being used to grade out any excess of soil above the roots.

10. Various summer and winter crops have been grown between the trees from the time of their planting until now.

11. The cost of working has not been greater than that of the average orchard in Victoria.

Thus far the trees under notice have clearly demonstrated that hard cutting during the nursery stages is a practical necessity under average Victorian conditions, but a great difference exists between the requirements



BRANCH OF PLUM IN FRUIT.

Over 9 feet in length.

of such trees as apples and pears, or peaches and apricots. Apples usually call for three or four close prunings before being allowed to run into slender branches, whilst pears, if at all sturdy and well supplied with foundation branches, may require but a single cutting back before allowing the head to form.

Some of the best examples illustrated in this article received but one or two winter prunings, the work of the remaining two years consisting of

BRANCH OF APRICOT IN FRUIT.
Over 10 feet in length.

disbudding and stopping excessively strong wood in spring and early summer. Again, the peach requires more persistent pruning than does the

apricot in early life, and for these reasons: Peach branches are liable to run too light, in which case they cannot last long; whereas the apricot makes excessively strong wood, if pruned at all hard, or it may suffer from gumming, and thereby fail to make a sound and shapely tree. Under the most ordinary conditions, peaches require about three close prunings, and each followed by very careful work in spring; whilst apricots, if pruned hard at planting, and again the year after, will usually be found to make branches of sufficient number and substance.

Of course, it must never be forgotten that trees are individuals, and that each, being stationary, occupies a more or less unique position. Therefore, a shape, size, and degree of vigour favorable to one may prove quite inadequate to another. What these Demonstration orchards clearly prove is that the more intelligently the tree is designed, the sooner will it be in a position to bear fruit without check or injury to its main wood.

Another point may be again referred to, since it is, perhaps, the most important lesson of all in connexion with orchard work in Victoria—the surface form, and condition of the soil. No method of pruning or surface cultivating could possibly have resulted in such trees as are here illustrated, had the soil not been boldly ridged, increased in quantity and quality, and mulched throughout the hot season. Those interested in this subject should read an article on "Soil Surfaces" which appeared in the *Journal* for June, 1905. In brief, the soil, as it exists in these Demonstration orchards, is moist over a longer period of summer, and warm and dry over a longer period of winter, than are the surrounding areas which have been cultivated over their natural surfaces.

The illustrations of mature trees are intended to show the result of thinning as against the common practice of cutting over the heads of trees regardless of their age, size, and actual requirements. The peach tree is a type which may well be striven for in all the best peach country. In very hot and dry positions it may be a little more upright and robust in its main wood, since vertical growth makes for vigour and long life; but in no case should the top of the head wear a bunched and barbered look, as this can only be obtained at the expense of barrenness in the lower limbs, as well as inducing premature decline of the whole tree.

The branch which is illustrated on page 465 was taken from a full-sized plum, having a spread of 16 to 18 feet, and it shows fruit within 4 inches of the trunk, and continuing over all its ripened wood. It may be noted that, though the crop is a heavy one, ample space and sound leaves exist for the development of a crop in the following year.

Plums are, as a species of fruit, the least capable of bearing in the dark interiors of robust and self-shading trees. Hence the necessity for keeping their extremities so open and light in substance as to insure ample means for true leaf development in the lower parts. The foregoing illustration was taken from a tree which had practically ceased to bear through the crowded nature of its top growth. Two years thinning-out, and a little summer work in the form of checking excessive shoots, led to the results shown.

The full-length branch of apricot, cut direct from and fruiting within 9 inches of the trunk, is a further illustration of the value of spacing the branches and keeping their extremities open and light. Moreover, it is usually desirable to secure a great proportion of spreading, or more or less horizontal, wood in apricot trees. The tree from which this branch was

taken has been equally clothed with fruit for several years in succession. The pruning has been of the lightest description—taking away any excess of shoots in the top, and cutting out any damaged, crossing, or exhausted wood within the body of the tree.

Finally, these illustrations and remarks are to be regarded as appropriate to the regions under notice. In a general way, three more or less distinct shapes and degrees of vigour are necessary to fruiting trees in Victoria. This article has dealt with variants of one type only. Another article, with a complete set of diagrams, will show what is desirable and obtainable in different parts of Victoria.

THE ORCHARD.

James Lang, Harcourt.

The weather during the past two months has been unusually mild, with an almost entire absence of frosts, in contrast to last winter, which was abnormally cold and late. Should this mild condition of the weather continue we may fully expect an early spring; orchardists will, therefore, have to be up and doing in order to get the work well advanced before its advent. Planting and pruning operations should now be brought to a conclusion by the end of the month. Any old and worn-out fruit trees should be headed well back to the fork of the tree, and, if of a good variety, allowed to shoot again. As more shoots will start into growth than what are required, these should be thinned out, leaving only those necessary to reform the tree. The ends of the stock where cut off should be smoothed over with a sharp knife, and rubbed with some paint to keep out the wet and prevent decay. If the variety is a poor one, it had better be grafted with a more suitable and up-to-date variety. By this means the life of the tree is renewed, provided the stock is healthy. Last winter the writer headed back in this way a number of Stone Pippin trees, which were old and unprofitable; every one of these has now made a healthy growth of strong wood, and, in two or three years, will again be bearing good crops of first-quality fruit.

Peach trees will now require attention to keep the aphis under. There is no remedy better than the old tobacco and soap solution; put 1 lb. of tobacco leaf in a tub, and pour over it 4 gallons of boiling water, cover it over, and allow it to infuse for an hour or two. Then dissolve 2 lbs. soap in 2 gallons of water, add this to the tobacco water and make up the whole to 20 gallons of spray. Kerosene emulsion is also good for the aphis. Boil ½ lb. soap in 1 gallon of water, and, when dissolved, add 2 gallons kerosene and churn briskly through a force pump for about ten minutes until thoroughly mixed; this should be made up to about 30 to 40 gallons.

As red spider has been very prevalent during the past summer, all kinds of fruit trees should be sprayed with the kerosene emulsion to destroy it; be careful to spray the under side of the branches and small spurs, as it is in those places where the red spider harbours during the winter. The codlin moth should also be looked after by scraping the trees of all loose bark, and stopping up any holes that may harbour the grub; broken ends of limbs should be cut clean off. One grub destroyed now prevents quite a large number appearing in the springtime.

POTATO EXPERIMENTAL FIELDS, 1905-6.

George Seymour, Potato Expert.

The object of the following experiments was to test the effect of artificial manure, farm-yard manure, and lime, on the cultivation of potatoes; also to test the cropping qualities of various kinds of potatoes in different soils. They were carried out on the potato section of the "5-acre" forage fields, 1905. The area planted in each instance was 1 acre, divided into six sections, one of which received no manure, three various dressings of artificial manure, one lime, and one farm-yard manure, where practicable. From 6 to 22 varieties were used in the plots, each drill being 6 chains long, with an even number of sets in each section, so that practically there were six sets of experiments with each variety of potato. It is to be regretted that, owing to the unevenness of the soil on some of the plots, these manure tests are not of as much value as they would otherwise be, and it must be also stated that some of the land could not in any sense be regarded as a potato soil. Yet on some of these remarkably good potatoes were grown, notably at Mr. Anderson's, Digger's Rest, where the difference in yield, owing to the use of manure, was very marked, and the difference in the type and quality was even more marked. On the unmanured or check section in some of the varieties it was almost impossible to find a single tuber large enough for table use; they were not only small and irregular in shape, but lacking type and quality.

One thing may be mentioned in connexion with the use of potash, viz., the tendency to produce scab; this was also present to a small degree in the section dressed with farm-yard manure. The quantity of potatoes affected by scab seems to be on the increase, and it would be advisable for growers to try the effect of pickling or dressing their seed before planting with either of the following preparations:---Half-pint formalin to 15 gallons water—soak the seed for two hours; or, 1 oz. corrosive sublimate to 7 gallons water -immerse for 1½ hours.

It is to be regretted that in some cases the results were very disappointing, owing chiefly to the continued wet weather at the end of last winter and early spring, which seriously interfered with the preparation of the land on several of the plots; in one case a plot had to be abandoned on that account. The work of planting was also delayed from the same cause, some of the plots being a month later than they should have been.

The results shown at the foot of the accompanying table are for a number of varieties planted by Mr. Jellie himself, on an unmanured plot. They were nearly all heavy-yielding varieties, and the land being in good heart, the average was over 10 tons per acre. The only light-yielding sort was the Brown's River, grown from a parcel of seed bought on the market. It yielded a little over 5 tons per acre, but gave a very poor return of tubers fit for market. To the growers who visited the field to watch the operation of digging and selecting seed, it, however, proved a valuable object lesson, and illustrated in a practical manner the failure of many growers who buy seed on the market, as more than two-thirds of the produce was discarded. Twenty-five per cent. of the plants were of the wild white bloom strain, and fifty per cent. were yellow-fleshed or inferior in quality. These averages were duly noted at the time of digging, and

will form the basis for future experiments, and will prove the value of the selection of seed at the time of lifting the crop, as the seed saved from this plot will be planted again next season.

Although the general results may appear disappointing, still some valuable information has been obtained, and a basis laid for future operations. All the varieties were closely culled, and the results noted, so that the improvement of the standard of the different varieties and strains can be ascertained.

IMPORTED VARIETIES.

The varieties imported by the Department of Agriculture were divided into two lots. One, consisting of 20 varieties, was planted at Mrs. Bland's farm, Yarram; and the other (25 varieties) at Mr. E. S. Hill's farm, Iona, Bunyip. The former were planted on 2nd October, the land being lea ground in fairly good condition. The sets came up almost without a miss, and at the end of November the whole crop looked very promising, but a heavy fall of rain occurred on the 2nd December, which completely flooded a large portion of the ground, and rendered it impossible to work the land, consequently the crop was only a poor one. When visited on 6th December the plot showed the effects of the manures in a marked degree, which totally disappeared before the plants reached maturity, thus showing the injury caused by the rain.

The plot at Bunyip was on a rich peaty soil. The land was well prepared, and the crop planted on 7th October. Like the plot at Yarram, the crop came up well, and gave promise of a good return, but was unfortunately cut to the ground on 28th November, on which date Mr. Hill reported 8 degrees of frost. This plot was visited on 16th December, when it had the appearance of a crop just coming through the ground. The check seriously interfered with results of the plot, which otherwise gave promise of being one of the best plots of the season, as the land was in good heart, well prepared, and the attention to the growing crop all that could be desired.

VALUE OF THE IMPORTED VARIETIES.

There can be no doubt that a number of the imported potatoes will prove a valuable addition to those already grown in the State. In point of quality Sir John Llewellyn will maintain its British reputation as an early maturing potato of first-class quality, showing the whiteness of the flesh of Carman No. 1, with a finer texture and flavour equal to Beauty of Hebron; but, like most of the fine quality early sorts, it is a light cropper, and, if good yields are to be obtained, it must receive generous treatment. Duke of York is another early variety, and a fair cropper; it produces an even-sized lot of tubers, with very few small ones; has a yellow skin and flesh, cooks well, with a peculiar sweet flavour, but on account of its colour is not likely to take on the local market. Duke of Rothesay is a very hardy early sort, and a fairly good cropper; and so is the Early Puritan, a potato well known for some years on the local market.

The heaviest cropper of all the early sorts is the British Queen, which in British experiments has returned as high as 17 tons 12 cwt. per acre; but so far it has not maintained its reputation, the highest yield being 5½ tons in section D at Mr. Duff's plot, Carrum. On account of its blight-resisting quality it has been inquired for in New Zealand for seed. Amongst the early varieties may be included the Duchess of Buccleuch, which gave a consistent return in all the sections of the Iona plot, where

the average weight was over 2 tons 12 cwt., section A showing 3 tons. Of the main crop varieties, The Factor, Warrior, Scottish Triumph, and Up-to-date came in the order mentioned. Of all these, perhaps the Up-to-date must be considered the most profitable potato, having come out top in the most recent experiments in Great Britain as a disease-resistant variety. The verdict of the great British authority, Mr. W. P. Wright, who says it is "the greatest potato that has come out for a hundred years," will, no doubt, be indorsed in New Zealand; but probably The Factor, Warrior, or Scottish Triumph would take the local market better, as they are whiter in the flesh, and have a better appearance when cooked.

AVERAGE YIELDS OF BEST EARLY VARIETIES.

Variety.	Tons.	Cwt.	Qrs.	Lbs.	Yield of Best Section.	Tons.	Cwt.	Qrs.
Duchess of Buccleuch ...	2	12	2	18	A	3	0	0
Sir John Llewellyn ...	2	6	2	18	B	2	12	0
Duke of Rothesay ...	2	6	2	18	F	3	2	0
King Edward VII. ...	2	8	0	0	F	2	16	0
Early Puritan ...	2	3	1	9	E	2	12	0

AVERAGE YIELDS, BEST MAIN CROP.

Variety.	Tons.	Cwt.	Qrs.	Lbs.	Yield of Best Section.	Tons.	Cwt.	Qrs.
The Factor	2	12	0	0	A	3	4	0
Warrior	2	10	2	18	D	3	2	0
Scottish Triumph ...	2	4	1	9	B	2	16	0
Up-to-date	2	2	2	18	F	2	10	0

OLD VARIETIES.

Twelve or fourteen old varieties were planted in the different plots, most of which gave very satisfactory results. Among these one known as the Copper Skin proved itself worthy of more attention than it has received at the hands of growers; it is a consistent cropper, throws very few small potatoes, and the quality is quite equal to the old Pinkeye. In Mr. Jellie's plot at Woodford it gave a yield equal to 8½ tons per acre. In the white skins, Sutton's Abundance and Clark's Main Crop gave very satisfactory results, the former producing very large tubers of good shape and quality, the latter throwing a large number of medium-sized tubers, with but few very large ones. Daniel's Sensation (also white skinned) gave good results; it is a very vigorous grower, stands frost well, and is of good quality. One of the best early ones was that planted under the name of Fox's Seedling. I cannot say whether the name is correct, as I have been unable to trace the history of it. In a good soil it will give a heavy yield; at Woodford it gave a return equal to 14 tons 8 cwt. It is a good cooker, and is quite equal to Beauty of Hebron. Bismark is another good variety; it did well in the Warrnambool district.

RED SKINS.

Much has been said about the deterioration of the "reds." Many contend that their day is past, but there is no doubt that the old Brown's River and Tasmanian Red are still the most popular main crop varieties on the market. These two varieties were planted in four different plots. Those marked Nos. 1 and 2 are the same, the numbers being used to

distinguish different strains of seed; the returns were very satisfactory, the average being over 4 tons per acre, and better results may be expected next season, as the seed has been heavily culled. In order to obtain good yields of either of the above varieties the land must be in good heart.

THE EFFECT OF PASTURE IN THE ROTATION.

There can be no doubt that the very satisfactory returns obtained in the Woodford plots, which averaged over 10 tons per acre, were due in a large measure to the fact that the land had recently been under grass. the rotation being five years in pasture, then a crop of potatoes, followed by hay and the present crop of potatoes. If growers followed the practice of sowing down to grass and clover in the old potato-growing districts, the yield of the State would be maintained on a little more than half the present area. In addition, the quality of the produce would be greatly enhanced, so that about half the land under potatoes, the other half being in pasture, would yield as many potatoes, and the grower would obtain a far more profitable return than at present.

NAMES OF VARIETIES.

Much confusion has arisen in the past through potatoes being called by wrong names. In some cases the same variety is known by four different names. For instance, many white-skinned potatoes are called Snowflake. When this potato was first introduced it was considered an early variety; but now The Acme, White Elephant, and Prolific, all late maturing sorts, are called Snowflake in different districts.

Much damage is also being done to the seed trade by inferior or late-maturing varieties being supplied for early ones. For example, Acme and Up-to-date have been sold for Carman No. 1, and growers in New Zealand and other places are asking to be provided with a Government certificate as to variety; but the grower is the proper person to supply this. Certainly, there are varieties that cannot be mistaken, but when it comes to the white-skinned ones it is impossible at all times to identify a potato without growing it, because there are so many that resemble each other, or vary so much in appearance when grown in a different soil, that they lose many of the characteristics of the variety to which they belong.

Results of Manure Experiments.

Mr. F. E. Lee, Agricultural Superintendent, has kindly furnished the following report on the results of the manure experiments conducted by him:—Regarded purely from a manurial point of view, the recent experiments with potatoes have in the majority of fields been inconclusive. It will be remembered that the spring of last year was particularly cold and wet, and frosts prevailed till a far later period than ordinarily. This fact, in conjunction with lack of care during the growing period, and a spell of dry weather from October to March, were the main causes of the comparatively poor returns in many districts. A survey of the localities in which many of the fields were situated is sufficient to indicate that the soils could in no wise be considered as typical potato land.

It is pleasing to find that in some instances the manure dressings have not only produced substantial increases in yield over the unmanured portion, but the increases are proportionate, thus showing that with intelligent fertilization profitable yields of potatoes can be raised in localities hitherto considered unsuitable for this crop.

MANURE DRESSINGS.

The potato section occupied 1 acre of the 5-acre experimental forage fields, and was further subdivided into six equal portions, lettered A to F. To section A a dressing of 2 cwt. superphosphate was given; to section B the same amount of superphosphate, together with 1 cwt. nitrate of soda; section C received no manure, and serves as a contrast for all other sections; section D received the same treatment as B, together with ⅔ cwt. of sulphate of potash; section E received a dressing of lime at the rate of 5 cwt. per acre; and section F was dressed with stable manure, as nearly as possible, at the rate of 10 tons per acre. Although only requiring a small amount of stable manure, considerable difficulty was experienced in procuring it, and only in a limited number of cases was it applied and ploughed in at the proper moment. I am, therefore, forced to the conclusion that no great reliance can be placed on the result of section F in the first year's trials.

The dates of sowing in various localities and the classification of varieties are more fully dealt with by my colleague.

HARVEST RETURNS OF PLOTS.

Experimenter.	A.	B	C	D.	E.	F.
	tons.	tons.	tons.	tons.	tons.	tons.
Mr. Anderson, Digger's Rest ...	1·7	2·0	0·8	2·3	1·0	1·3
Mr. Wilson, Whittlesea	0·6	0·9	1·2	2·0	1·2	0·4
Mrs. Bland, Yarram	1·7	1·1	0·6	0·6	0·5	0·4
Mr. Hill, Bunyip South	2·1	2·0	1·9	1·3	2·1	1·3
Mr. Cameron, Condah	5·4	6·0	4·2	5·4	4·1	3·9
Mr. Scanlon, Cobden	5·1	5·0	2·7	5·1	2·5	2·7
Mr. Duff, Carrum	4·5	4·8	4·4	4·7	4·9	5·0
Mr. Syme, Mordialloc	2·4	2·3	1·2	0·8	1·2	1·5
Mr. Collins, Illowa	4 0	4·2	4·0	3·7	3·8	3·5
Average yield per acre ...	3·0	3·1	2·3	2·9	2·1	2·2

These returns at first sight do not appear to have very clearly demonstrated the value of fertilization, and yet, taking the high prices ruling for potatoes during the past season, there is a good margin of profit shown over the cost of the manures. For example, the unmanured section C produced an average yield of 2.3 tons per acre; section A, dressed with 9s. worth of superphosphate, produced 3.0 tons, or an increase of 14 cwt. Estimating potatoes of good quality to have been worth £7 a ton, there is a margin of profit of £4 9s. after paying for the manure. Section B, costing 22s. 6d. per acre to manure, shows a net profit of £4 8s. 9d.; section D, costing 31s. 10d. per acre to manure, shows a profit of nearly £2 9s. 5d. per acre; section E, dressed with lime, as might have reasonably been expected, shows little or no benefit the first year. It is probable that crops subsequently planted on the lime section will show an improvement, both in quality and quantity. As previously pointed out, section F, dressed with stable manure in some cases, has had little chance of showing its capabilities in the first year's trials.

HARVEST RETURNS FROM POTATO SECTIO

	Mr. P. Duff, Carrum.						Mr. Collins, Illowa.						Mr. Scanlon, Elingamite.						Mr. Cameron, Condah.						Mrs. Blan Yarram.				
	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	
Up-to-Date*	7.4	7.2	6.5	6.3	6.4	6.3	7.0	8.0	7.2	5.0	5.4	5.4	7.6	6.5	2.5	5.3	2.1	3.5	9.0	10.0	6.7	9.6	5.8	7.6	2.0	1.5	.6	.4	
Scotch Grey	6.0	6.0	5.8	5.5	5.8	6.2	3.1	3.2	3.2	2.6	2.5	2.4	5.2	3.8	3.0	4.4	1.9	3.5	7.2	7.3	3.7	6.0	4.0	3.6	..	..	..	..	
Brown's River ..	5.8	5.5	5.0	6.3	5.4	6.9	4.1	3.6	4.5	4.6	3.7	3.4	4.1	3.5	1.9	5.5	2.9	2.9	4.3	3.9	4.2	4.3	4.3	2.6	..	..	..	..	
Sutton's Abundance	5.8	5.0	5.0	6.3	6.0	6.3	6.2	6.8	4.6	5.3	6.2	6.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Flat Top No. 1 ..	4.7	4.2	3.9	3.8	4.7	3.0	3.0	3.7	3.5	4.0	3.4	3.1	7.2	5.6	3.4	4.9	2.7	2.4	4.3	5.8	3.6	4.2	3.3	3.6	..	..	..	..	
Clark's Main Crop ..	7.6	6.9	6.2	7.3	8.6	6.0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Fox's Seedling ..	5.1	5.3	5.6	4.9	5.3	5.7	5.3	4.6	5.7	4.5	4.0	5.7	3.8	4.9	2.3	5.9	2.3	2.0	..	..	..	..	..	..	..	..	..	..	
Copper Skin	5.7	6.3	5.0	5.1	5.1	5.4	3.7	3.9	3.7	3.4	3.7	2.9	..	..	..	..	..	..	4.7	4.3	3.4	4.3	4.2	3.6	..	..	..	..	
Rose ..	1.8	1.6	3.1	2.8	3.3	1.6	2.1	2.2	2.5	1.8	2.1	1.5	3.3	2.8	2.1	3.8	1.5	1.5	..	..	..	..	..	..	..	..	..	..	
Bismark ..	6.1	6.0	6.4	6.8	8.3	7.3	3.6	4.5	4.6	4.6	4.5	3.2	4.7	4.5	4.0	6.5	4.1	3.4	..	..	..	..	..	..	..	..	..	..	
Beauty of Hebron	4.8	6.1	6.0	6.1	6.6	7.7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Daniel's Sensation	3.3	4.4	3.8	4.9	4.0	4.9	3.7	3.7	3.1	3.1	3.9	2.8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Carman No. 1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Satisfaction	3.3	2.9	4.3	3.2	3.5	4.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Lapstone Kidney ..	1.7	2.5	2.3	2.8	2.8	3.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Northern Star* ..	4.1	3.7	3.4	4.0	4.1	4.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.5	1.5	.8	.6	
Goodfellow*	4.1	3.6	3.1	3.5	3.7	4.5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.1	.8	.3	.2	
Duke of York* ..	1.5	2.3	1.8	2.6	2.4	2.0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.1	.8	.5	.6	
20th Century* ..	4.3	4.6	4.8	4.9	4.7	6.0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.8	1.0	.6	1.0	
British Queen* ..	4.3	4.9	4.0	5.5	4.8	5.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.3	1.7	1.3	1.7	
Sir J. Llewellyn*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.5	.8	.4	.4	
Scottish Triumph*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.8	1.4	.6	.4	
General Kitchener*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.5	.6	.6	.6	
Early Puritan* ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.7	.6	.3	.4	
Duchess of Buccleuch*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.2	1.3	.5	.6	
Ever Good*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.5	.3	.3	.3	
Dunlop* ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.3	.8	.6	.3	
The Factor*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.9	1.0	.7	.6	
The Warrior*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.4	1.5	.8	.9	
The Foundling* ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.2	.4	.3	.5	
Empress Queen* ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.7	.8	.5	.4	
Duke of Rothesay*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3.0	2.8	1.1	1.7	1
Royal Kidney* ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.9	1.8	.9	1.3	
King Edward 7th*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.5	1.2	1.1	.9	1
The Bruce	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Table Talk*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Flat Top No. 2 ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3.3	4.8	3.6	4.2	3.1	2.5	..	..	..	..	
Brown's River No. 2	..	..	..	..	..	..	3.0	3.0	2.4	2.6	3.1	2.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
General French*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Snowflake	3.2	3.2	3.4	3.4	3.6	3.8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
	4.5	4.6	4.4	4.7	4.9	5.0	4.0	4.2	4.0	3.7	3.8	3.5	5.1	5.0	2.7	5.1	2.5	2.7	5.4	6.0	4.2	5.4	4.1	3.9	1.7	1.1	.6	.6	

* Varieties imported by the Depa

In Mr. Jellie's field, which was unmanured, the average yield per acre from the following varieties was obtai
Skin, 8.5 tons; Fox's Seedling, 14.4 tons; and Brown's River, 5.1 tons.

VE-ACRE FORAGE FIELDS—SEASON 1905

Mr. E. S. Hill, Iona.					Mr. Anderson, Digger's Rest.						Mr. Wilson, Whittlesea.						Mr. D. Syme, Mordialloc.						Average of all Sections.					
B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F
2.0	2.3	1.8	2.1	2.5	2.8	2.7	1.1	3.4	1.6	1.8	..	..	..	..	..	..	..	..	..	..	..	..	5.4	5.4	3.8	4.5	3.4	3.9
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3 5	1.5	1.1	1.2	2.0	2.3	5.0	4.3	3.3	3.9	3.2	3.6
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4.5	4.1	3.9	5.1	4.0	3.9
..	..	..	..	..	1.8	2.1	.8	2.8	1.2	1.3	.3	1.1	1.4	2.8	1.2	.5	..	..	..	..	..	..	3.5	3.7	3.2	4.3	3.6	3.6
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4.8	4.8	3.6	4.2	3.5	3.0
..	..	..	..	..	1.7	2.2	1.1	2.5	1.5	1.6	.8	1.4	1.2	2.2	1.2	.4	4.9	2.8	2.1	1.3	2.2	2.3	3.7	3.3	2.6	3.3	3.3	2.5
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4.7	4.9	4.5	5.1	3.8	4.4
..	..	..	..	..	..	..	..	..	..	..	1.4	1.9	2.1	3.1	2.2	.8	..	..	..	..	..	..	3.8	4.1	3.5	3.9	3 7	3.1
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.4	2.2	2.5	2.8	2.3	1.5
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4.8	5.0	5.0	5.9	5.6	4.6
..	..	..	..	..	1.2	1.5	.8	1.8	1.1	1.2	.6	.9	1.3	1.4	1.0	.4	2.8	4.0	2.3	.9	.9	1.0	2.3	3.1	2.6	2.5	2.4	2.5
..	..	..	..	..	..	..	..	..	..	..	.6	.6	1.2	1.8	1.2	.2	1.5	1.7	.8	.3	.3	.6	2.2	2.6	2.2	2.5	2.3	2.1
..	..	..	..	..	1.5	2.0	.6	1.6	.4	1.0	.1	.4	.4	1.0	.6	.2	..	..	..	..	..	..	.8	1.2	.5	1.3	.5	.6
..	..	..	..	..	..	..	..	..	..	..	.6	.7	1.5	1.8	1.6	.6	2.3	2.3	1.5	.7	.8	1 0	2.0	1.9	2.4	1.9	1.9	1.9
..	..	..	..	..	..	..	..	..	..	..	.6	.9	1.2	2.1	1.3	.6	3.4	2.6	.7	.7	1.1	1.6	1.9	2.0	1.4	1.8	1.7	1.7
1.0	.9	.8	1.6	1.7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.3	2.0	1.7	1.8	2.2	2.3
2.2	2.6	2.0	2.4	2.7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.5	2.2	2.0	1.9	2.0	2.5
1.7	2.6	1.7	1.8	1.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.5	1.6	1.6	1.6	1.5	1.1
2.7	2.2	1.9	2.0	2.7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.8	2.7	2.5	2.6	2.4	3 0
2.2	1.8	1.7	1.9	2 5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.8	2.9	2.3	2.9	2.5	2.8
2.6	2.0	2.4	2.5	2.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.8	1.7	1.2	1.4	1.3	1.2
2.8	2.4	2.0	1.9	2.0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.0	2.1	1.5	1.2	1.0	1.2
2.3	2.4	2.8	2.4	3.0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.8	1.4	1.5	1.7	1.3	1.6
2.3	1.6	1.7	2.6	2.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.1	1.4	.9	1.0	1.4	1.2
2.4	2.1	2.0	2.4	2.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.6	1.8	1.3	1.3	1.3	1.2
1.6	1.0	.7	2.5	1.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.4	.9	.6	.5	1.4	.7
2.1	1.6	2.4	2.5	2.7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.6	1.4	1.1	1.3	1.4	1.5
2.3	2.5	2.2	2.8	2.8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.5	1.6	1.6	1.4	1.5	1.6
2.7	2.0	3.1	2.5	2.8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.2	2.1	1.4	2.0	1.5	1.6
2.3	2.5	2.0	2.4	2.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.3	2.5	2.0	1.6	1.9	1.9
2.3	2.1	2.2	2.2	3.0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2 2	1.5	1.3	1.3	1.3	1.6
1.9	2.2	2.2	2.5	3.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.7	2.3	1.6	1.9	1.8	2.0
2.2	1.8	2.0	2.1	2.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.3	2.0	1.3	1.6	1.4	1.6
2.4	2.2	2.3	2.3	2.8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.9	1.8	1.6	1.6	1.7	1.7
..	..	..	..	..	1.5	1.5	.8	2.2	.6	.9	..	..	..	..	..	..	2.9	.7	.5	.6	1.1	1.5	2.2	1.1	.6	1.4	.8	1.2
1.9	1.6	1.3	1.7	2.6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2.6	1.9	1.6	1.3	1.7	2.6
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3.3	4.8	3.6	4.2	3.1	2.5
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3.0	3.0	2.4	2.6	3.1	2.3
.8	1.5	.9	1.5	2.0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1.6	.8	1.5	.9	1.5	2.0
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3.2	3.2	3.4	3.4	3.6	3.8
2.0	1.9	1.8	2.1	1.3	1.7	2.0	.8	2.3	1.0	1.3	.6	.9	1.2	2.0	1.2	.4	2.4	2.3	1.2	.8	1.2	1.5	..	..	..	..	..	..

f Agriculture for experimental purposes.

atisfaction, 9.3 tons; Clark's Main Crop, 9.3 tons; Bismark, 8.5 tons; Up-to-Date, 16.1 tons; Copper

INDIVIDUAL CROPS.

Some of the fields under review have shown a much more regular response to the manure dressings than the average of the whole. This may be ascribed as much to the care and attention shown as to other causes. Badly drained places in some of the plots are responsible for the irregularities of yield. In the case of Mr. Syme's field at Mordialloc —section D was on a sand ridge, which reduced the yield of that plot considerably. Mr. Anderson's field at Digger's Rest has shown the most regular response to the manurial dressings. Being on sloping land, this field has shown a profitable increase on sections E and F, and the value of the experimental work on this farm will more than compensate the owner for the labour and trouble involved. It is somewhat regrettable that many persons who undertake experimental work do not maintain the enthusiasm with which they commence. I am frequently asked to excise the unmanured section as being of no service. In my opinion, the failures, or, what is perhaps the more fitting term, non-successes are more educative than those experiments which realize to the full the hopes of the experimenter.

CONCLUSION.

The experienced reader will see in this brief review of the potato experiments one fact that will not occur to a person not directly interested. viz., that it is too much to expect such a wide range of early, medium, and late varieties of potatoes to respond in anything like the same manner to artificial manures.

It may safely be assumed that some of the varieties tried have been on unsuitable soil, and with different periods of ripening the average results from a manurial point of view are hardly comparable. Nevertheless, viewing the whole question from a stand-point that does not regard idiosyncrasies of varieties, it is patent that artificial manures intelligently used can be made to render the same assistance to the potato grower as to the grower of other crops. It may be mentioned that the experiments are being continued for three years, the rotative principle being adhered to, so that at the expiration of that term the collected information should prove of the highest value to the potato grower in every district in the State.

THE PROCLAIMED PLANTS OF VICTORIA.

(Second Series.)

Alfred J. Ewart, D.Sc., Ph.D., F.L.S., Government Botanist; and J. R. Tovey, Herbarium Assistant.

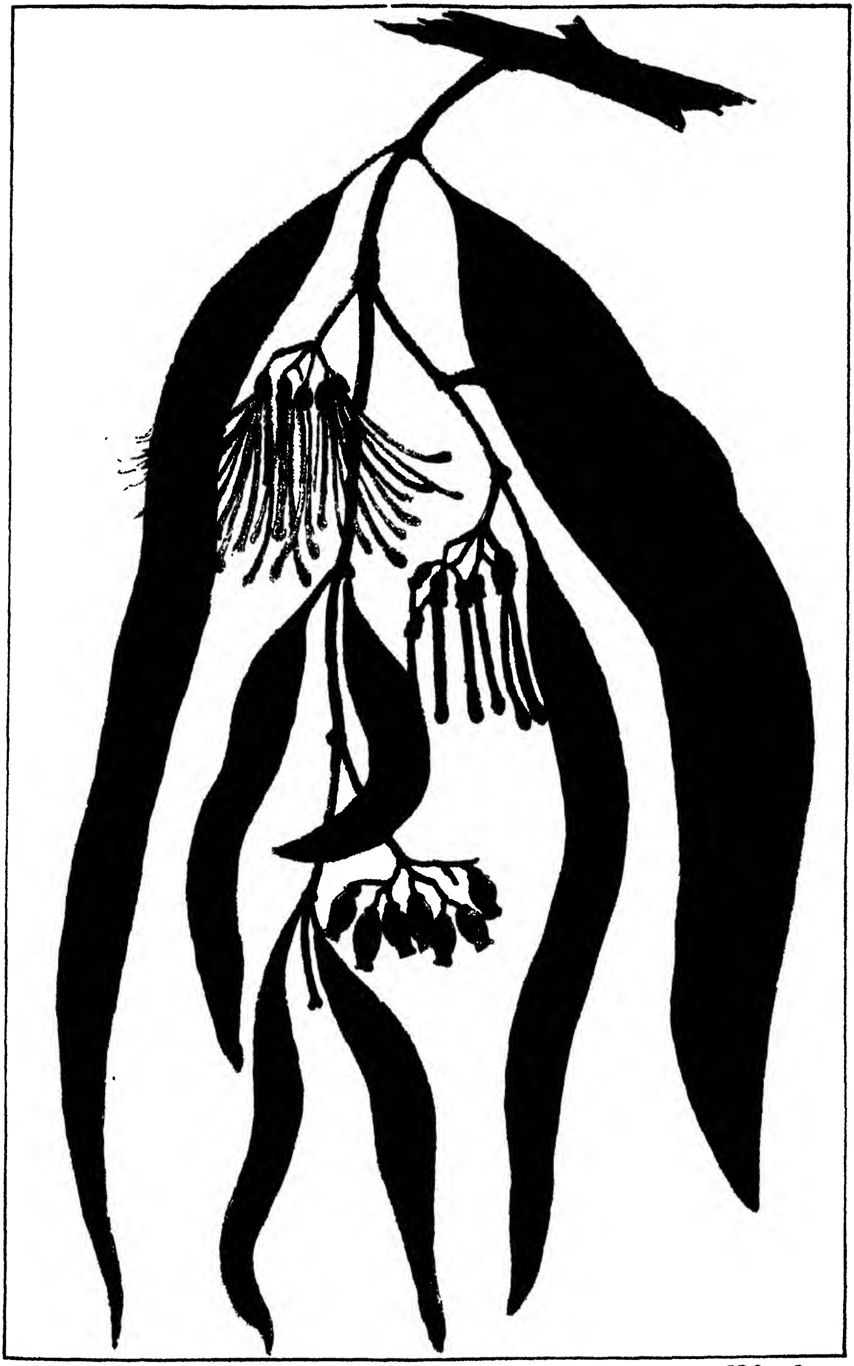
Since the issue of the Thistle pamphlet in 1893, 23 names have been added to the list of plants which are required to be destroyed under the Thistle Act. The present publication consists of a series of descriptions and illustrations of these plants which was originally prepared by Mr. Tovey, and which has been revised and issued in its present form.

The descriptions are made as simple as possible, and the coloured plates should aid in rendering identification a simple matter. Mr. G. H. Adcock, F.L.S., Principal of the Viticultural College, Rutherglen, and Mr. J. W. Audas, of this branch, rendered valuable service in obtaining specimens suitable for illustration.

PLATE 2.

O Wauer Del. J R Tovey, Direxit

PLATE 3.



O Wauer, Del. *J R Tovey, Direxit.*

HANGING MISTLETOE.

Only short, safe, straightforward directions for eradication are given, since the fancy methods of weed eradication frequently advocated are less certain, are frequently dangerous, and are often as costly as the simple and thorough, but more laborious methods. Poisonous sprays such as copper sulphate may sometimes be used to keep down weeds (charlock &c.) in the seedling condition, especially if applied during dry weather, but their use is never advisable if it can be avoided, and when once a perennial is firmly rooted its destruction requires doses of poison sufficient to injuriously affect the soil and surrounding vegetation for some time. No compounds containing arsenic should be used for the poisoning of weeds on pastures or cultivated ground.

There is no doubt that many of the proclaimed weeds here described are spreading rapidly, with increasing injury to agriculture, and that this fact is due to the imperfect administration of the Thistle Act. In so far as the latter is due to ignorance, the issue and wide circulation of the accompanying descriptions and plates should remove one source of laxity, but the wide divergence in the attention paid to the Act in neighbouring shires will always militate against the permanent eradication or suppression of any particular weed. Permanent good can only be attained by simultaneous and centrally organized efforts, extending over wide areas surrounded by natural barriers to migration.

The Mistletoe.

Loranthus celastroides, Sieber. (*Loranthaceæ.*)

A parasitic glabrous shrub, on branches of trees. Leaves opposite, from a rounded egg-shape to a narrow lance-shape, and, when narrow, often sickle-shaped; thick in structure. Flowers in loose cymes, usually terminal; petals elongated, five or six, free, often yellowish or somewhat reddish, soon spreading or reflexed; loosely hung anthers. Fruit almost pear-shaped, yellowish green. The Mistletoe is a native of Australia. This parasite spreads over the trees, and eventually destroys them. It grows on gum trees, but on others also. The best method of eradication is to have the infested branches entirely removed and burned, as well as any young branches on which seedlings may have established themselves. Proclaimed under the Thistle Act for the whole State—October, 1904.

The Hanging Mistletoe.

Loranthus pendulus, Sieber. (*Loranthaceæ.*)

A glabrous shrub, parasitic on the branches of trees. Leaves mostly opposite, egg-shaped, or elongated, and of nearly equal breadth near base and apex; from 2 inches to 10 inches long, and sometimes even longer, seldom assuming a heart-shaped form. Flowers in axillary cymes; petals, usually five, elongated, soon spreading or bent back. Anthers adnate. Fruit brownish green, quite viscid (sticky); distinctly contracted at the summit. The Hanging Mistletoe is a native of Australia. Like the preceding one, this parasite is very destructive. Both, if not checked, spread over the trees and kill them, thus causing great loss in our timber resources. It is especially common on Eucalypti, but also grows on Acacias and other trees. The infested branches should be cut off and burned. Proclaimed under the Thistle Act for the whole State—October, 1904.

(To be continued.)

Supplementary List showing Results of Analyses of Samples of Artificial Manures Collected throughout the State under the Provisions of the Artificial Manures Acts 1904–5.

Sample No.	Description of Manure.	Manufacturer or Importer.	Moisture. Found.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Water Soluble. Found.	Water Soluble. Guaranteed.	Citrate Soluble. Found.	Citrate Soluble. Guaranteed.	Insoluble. Found.	Insoluble. Guaranteed.	Total. Found.	Total. Guaranteed.	Estimated Value per ton.	Where Samples obtained.
			%	%	%	%	%	%	%	%	%	%	%	£ s. d	
16345	Superphosphate, Florida	Cuming, Smith, and Coy., Melbourne	6.59	..	..	19.63	18.00	1.34	1.50	0.47	1.50	21.44	21.00	4 14 0	Pyramid Hill
16495	" "	" " "	3.71	..	..	17.41	17.00	1.61	1.00	4.93	2.00	23.93	20.00	4 9 7	Cobram
16498	" "	" " "	9.85	..	..	19.58	18.00	0.65	1.50	0.10	1.50	20.33	21.00	4 10 9	Numurkah
16500	" "	" " "	11.44	..	..	18.86	18.00	1.73	1.50	0.83	1.50	21.42	21.00	4 12 6	Shepparton
16501	" "	" " "	9.41	..	..	19.40	18.00	1.44	1.50	0.63	1.50	21.57	21.00	4 13 7	"
16505	" "	" " "	9.19	..	..	19.37	18.00	1.53	1.50	0.51	1.50	21.41	21.00	4 13 8	Mooroopna
16506	Superphosphate, Nitro	" " "	9.46	1.06	(a)1.00	11.26	10.01	5.55	3.88	4.98	5.48	21.79	19.37	4 18 6	"
16507	" "	" " "	8.89	1.06	1.00	10.59	10.01	5.86	3.88	5.31	5.48	21.76	19.37	4 17 10	"
16518	" "	" " "	10.23	1.02	1.00	12.97	10.01	4.67	3.88	4.13	5.48	21.77	19.37	4 19 9	Beaufort
16533	" "	" " "	8.00	0.83	1.00	9.94	10.01	5.93	3.88	7.09	5.48	22.96	19.37	4 18 1	Nagambie
16843	" "	" " "	7.80	1.18	1.00	10.52	10.01	3.03	3.88	8.20	5.48	21.75	19.37	4 16 1	Ararat
16534	Bonedust and Superphosphate	" " "	9.86	1.60	1.50	7.67	7.50	7.37	5.00	5.93	8.50	20.97	21.00	4 18 0	Nagambie
16610	" " "	" " "	9.04	1.03	1.50	9.06	7.50	7.05	5.00	4.65	8.50	20.76	21.00	4 13 4	Euroa
16602	Thomas Phosphate ..	" " "	..	..	..	..	..	11.19	..	8.46	..	19.65	17.00	3 10 1	Benalla
16482	Superphosphate, No. 1	Mt Lyell M. and R. Coy., Melbourne	12.99	..	..	19.30	18.50	2.22	1.25	..	1.00	21.52	20.75	4 15 8	Tallygaroopna
16503	" "	" " "	12.25	..	..	18.88	18.50	2.35	1.25	1.00	1.00	22.23	20.75	4 15 3	Mooroopna
16511	" "	" " "	11.96	..	..	19.56	18.50	2.48	1.25	0.96	1.00	23.00	20.75	4 18 10	Tatura
16519	" "	" " "	12.65	..	..	19.15	18.50	2.24	1.25	0.67	1.00	22.06	20.75	4 15 9	Beaufort
16841	" "	" " "	11.91	..	..	17.46	18.50	2.06	1.25	3.54	1.00	23.06	20.75	4 10 2	Ararat
16546	" "	" " "	12.38	..	..	19.31	18.50	2.31	1.25	1.19	1.00	22.81	20.75	4 17 2	Rutherglen
16548	" "	" " "	9.78	..	..	21.65	18.50	0.85	1.25	..	1.00	22.50	20.75	5 0 9	Springhurst
16889	" "	" " "	11.81	..	..	19.32	18.50	1.28	1.25	3.08	1.00	23.[illegible]	20.75	4 15 0	Hamilton
16512	Superphosphate, No. 2	" " "	9.84	..	..	16.20	17.00	3.65	0.75	2.56	0.75	22.41	18.50	4 10 0	Tatura
16513	Superphosphate, Nitro	" " "	13.02	2.13	(b)1.60	15.80	16.00	1.97	1.00	0.59	0.75	18.36	17.75	5 7 5	"
16612	Bonedust and Superphosphate, No. 1	" " "	11.32	1.11	(a)1.30	17.61	13.50	1.52	3.75	3.16	4.50	22.29	21.75	5 5 11	Euroa
16457	Superphosphate, Standard Brand	Renard Fertilizer Coy., Melbourne	10.51	..	..	16.70	17.00	1.40	1.50	0.50	0.50	18.60	19.00	4 1 2	Nathalia
16460	" " "	" " "	7.02	..	..	16.25	17.00	3.38	1.50	0.36	0.50	19.99	19.00	4 6 11	Wunghnu
16509	" " "	" " "	10.24	..	..	15.83	17.00	3.61	1.50	0.64	0.50	20.08	19.00	4 6 3	Tatura
16858	" " "	" " "	9.19	..	..	16.70	17.00	3.53	1.50	0.77	0.50	20.00	19.00	4 10 0	Willaura

(a) Nitrogen calculated as in bone manure.
(b) Nitrogen calculated as ammonia, 1 per cent.; as in blood manure, 1.13 per cent.

SUPPLEMENTARY LIST SHOWING RESULTS OF ANALYSES OF SAMPLES OF ARTIFICIAL MANURES—*continued.*

Sample No.	Description of Manure.	Manufacturer or Importer.	Moisture. Found.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Water Soluble. Found.	Water Soluble. Guaranteed.	Citrate Soluble. Found.	Citrate Soluble. Guaranteed.	Insoluble. Found.	Insoluble. Guaranteed.	Total. Found.	Total. Guaranteed.	Estimated Value per ton.	Where Samples obtained.
			%	%	%	%	%	%	%	%	%	%	%	£ s. d.	
16510	Superphosphate, Standard B Brand	Renard Fertilizer Coy., Melbourne	11.28	..	.	13.07	12.75	3.85	1.30	1.06	0.24	17.98	14.29	3 15 1	Tatura
16554	Thomas Phosphate, Standard Brand	„ „ „	..	..	..	..	..	10.24	..	7.65	..	17.89	17.17	3 3 10	Wangaratta
16485	Bonedust and Superphosphate, Standard Brand	„ „ „	7.10	0.98	(a) 0.90	8.38	12.75	9.94	4.25	4.00	2.31	22.32	19.31	4 19 5	Shepparton
16531	Superphosphate, Wischer's	Wischer and Coy., Melbourne	4.60	..	.	20.12	18.00	0.95	1.50	1.20	1.50	22.27	21.00	4 15 5	Nagambie
16605	„ „	„ „ „	6.55	..	..	17.47	18.00	1.67	1.50	2.49	1.50	21.63	21.00	4 7 8	Violet Town
16859	„ „	„ „ „	6.30	..	.	18.38	18.00	2.06	1.50	2.36	1.50	22.80	21.00	4 13 2	Willaura
16614	Bonedust and Superphosphate	„ „ „	7.02	0.88	(a) 0.90	11.68	12.00	4.65	3.00	3.44	4.00	19.77	19.00	4 10 4	Euroa
16502	Superphosphate, No. 15	Australian Explosives and Chemical Coy., Melbourne	7.82	..	..	8.25	13.20	7.63	0.20	1.49	1.10	17.37	14.50	3 9 0	Mooroopna
16525	Superphosphate, Federal O. S.	„ „ „	8.83	..	..	18.28	18.00	1.99	1.50	0.89	1.50	21.16	21.00	4 11 2	Ballarat
16856	„ „ „	„ „ „	6.65	.	..	19.41	18.00	3.32	1.50	1.03	1.50	23.86	21.00	5 17 0	Willaura
16432	Superphosphate, Nitro	Colonial Manures Coy., Melbourne	11.02	1.30	(c) 0.60	8.36	10.00	3.86	5.00	6.06	2.50	18.28	17.50	4 9 8	Spencer-street Railway
16459	Superphosphate, No. 1	„ „ „	11.25	..	..	16.82	17.50	1.35	1.00	..	..	18.17	18.50	4 1 4	Wunghnu
16604	„ „	„ „ „	11.29	..	..	16.23	17.50	1.96	1.00	..	..	18.19	18.50	4 0 10	Violet Town
16615	„ „	„ „ „	11.86	.	..	16.96	17.50	2.31	1.00	0.19	..	19.46	18.50	4 5 7	Euroa
16603	Thomas Phosphate ..	„ „ „	..	..	..	..	..	11.44	..	9.89	..	21.33	18.00	3 15 5	Violet Town
16857	„ ..	„ „ „	..	..	..	..	..	13.35	..	7.09	..	20.44	18.00	3 14 7	Willaura
16607	Bonedust and Superphosphate	„ „ „	8.98	0.80	(a) 1.00	15.07	12.00	3.88	4.00	1.85	2.00	20.80	18.00	4 17 1	Violet Town
16522	Superphosphate, Hasell's "Jap"	A. H. Hasell, Melbourne	11.30	..	..	17.38	18.50	2.80	1.50	0.26	..	20.44	20.00	4 9 7	Ballarat
	„ „ „	„ „ „	8.06	..	..	21.23	18.50	1.19	1.50	..	..	22.42	20.00	5 0 3	Burwood
	„ „ „	„ „ „	9.04	..	..	21.00	18.50	1.16	1.50	..	..	22.16	20.00	4 19 1	Melbourne

(a) Nitrogen calculated as in bone manure.
(c) Nitrogen calculated as ammonia.

SUPPLEMENTARY LIST SHOWING RESULTS OF ANALYSES OF SAMPLES OF ARTIFICIAL MANURES—*continued.*

No. of Sample.	Description.	Manufacturer or Importer.	Nitrogen.		Phosphoric Acid.		Mechanical Condition.				Estimated Value per ton.	Where Samples obtained.
							Fine.		Coarse.			
			Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.		
			%	%	%	%	%	%	%	%	£ s. d.	
16561	Bonedust	J. Cockbill, Melbourne ..	3.94	3.50	20.32	18.25	41.14	..	58.86	..	5 9 0	Wangaratta
16528	"	Heinz Bros., Ballarat	3.94	3.12	18.94	19.38	62.55	..	37.45	..	5 9 9	Ballarat
16516	"	Cuming, Smith, and Co., Melbourne	2.96	2.50	21.09	21.00	37.50	..	62.50	..	4 19 6	Beaufort
16608	"	" " " "	2.77	2.50	21.00	21.00	52.75	..	47.25	..	5 1 0	Euroa

W. PERCY WILKINSON,
Government Analyst for Victoria
and
Acting Chemist for Agriculture.

Government Laboratory,
12th May, 1906.

DISEASES OF FARM ANIMALS.

S. S. Cameron, M.R.C.V.S.

V.—NOTIFIABLE DISEASES UNDER THE "MILK AND DAIRY SUPERVISION ACT 1905."

(*Continued from Page* 420)

Contagious Abortion in Cattle.

(*Slipping Calf or "Slinking."*)

Abortion, by which is meant the birth of the calf at any stage of development prior to the mature period of gestation, may occur as a result of accidental incidence of external forces, or may be directly due to contagion. It is true that any of the usual causes of accidental abortion may co-operate with the contagious element, and so increase the severity of the outbreak, and it is doubtless equally true that the occurrence of accidental abortion may be the starting point of an outbreak of contagious abortion, but as a rule the two forms can be sharply defined by inquiry into the surroundings and history of the case. That they should be so defined is of great practical importance; otherwise, through neglect of precautions which are necessary in the one case, but immaterial in the other, a ruinous disease may gain so strong a hold of the herd as to involve great cost and inconvenience in its eradication.

Accidental Abortion.

Amongst the causes of accidental abortion, the following may be enumerated:—Mechanical injuries which result in the death of the unborn calf (fœtus), and its detachment from the membranes of the womb, such injuries, for example, as are sustained through fence-jumping, being kicked or crushed in trucks, races, yards, or otherwise, hounding with dogs, jumping of other cows when "bulling," over-driving, and the like forms of external violence; ergotized grasses, smut and bunt or other forms of mould growth on fodder; fermentescible foods, such as clover, lucerne, and sorghum, eaten in immoderate quantities, and so causing "hoven" and bowel disturbance; foul, putrescent drinking water; the eating of frozen foods or the drinking of ice-cold water; severe constipation or bowel disturbance, or the administration of powerful purgatives, all causing excessive straining; the eating of irritant plants, such as savin, rue, and tansy; mental excitement, such as is caused by the sight or smell of blood, carrion, or other strange and terrorising objects; and finally many constitutional diseases, cows affected with pleuro-pneumonia or other disease accompanied by high fever being very liable to abort.

The precautions to be adopted after accidental abortion from any of the above causes are: First, the isolation of the aborted animal from other in calf cows for a period of a fortnight, or until all discharge has ceased, and the womb and genital passages have regained their normal condition. An aborted cow should not be bulled for at least three months after abortion. Second, the burning of the discharged fœtus and "cleansing" of fœtal membranes, and the daily burning of any clots or discharges

that are passed. The cow may be given a laxative drench composed of 12 ozs. of Epsom Salts, 2 ozs. of sulphur, and 1 oz. of ginger in a quart of warm gruel; and, as local treatment, the womb should be syringed out two or three times at daily intervals, or oftener and for a longer period if the discharge is foul-smelling, with a luke-warm antiseptic solution, say, one tablespoonful of Creolin or Lysol or Jeyes' Fluid to 2 quarts of blood-warm water.

CONTAGIOUS ABORTION.

This may be defined as a disease of the womb an infectious catarrh of the lining of the womb (uterus), resulting in the premature expulsion of the fœtus, and caused by the transmission from one animal to another of the specific germ of the disease. When introduced into a herd the disease assumes the character of an outbreak or epizootic. It is usually so introduced by a cow or bull from a herd in which the disease exists, and the chance of getting the complaint is one of the risks of buying cattle from unknown sources at sale-yards and auctions. Or it may be introduced by sending a cow from a healthy herd to a bull that has previously served aborting cows, or by grazing cows in a paddock in which others have aborted, or by any cattle traffic between an aborting herd and sound cattle. The infecting material is present in discharges and smears on the tail and quarters, and it may be conveyed by contact with infected bails, fences, rubbing posts, litter, attendant's clothing, or other such means. The disease has been repeatedly conveyed experimentally by inserting into the vagina of a healthy in-calf cow a small piece of cotton-wool smeared with the discharge from an aborted cow, or which had been previously inserted for a few minutes into the vagina of such a cow. Moreover, as showing that the causative germ is the same in all animals, the disease has been conveyed in the same way to the sow, ewe, goat. rabbit, and guinea pig, and mares, bitches, and cats can be infected if the virulence of the germ is intensified somewhat, as it appears to be by passing it through an intermediate host, such as the rabbit, instead of inoculating direct from the cow. Such experiments leave no room for doubt that the disease is a contagious one, and the conclusion is supported in a practical way by the beneficial results which follow on an antiseptic or germicidal method of treatment. In herds in which abortion has been prevalent for years the disease may be entirely suppressed by the adoption of this line of treatment.

The actual causative germ has not as yet been agreed upon. Organisms have been found by many investigators associated in the genital membranes, passages, or discharges in such a way as to indicate their connexion with the disease, but different observers have ascribed the causative agency to germs showing differences in structure or other identifiable characters, so that no agreement has been arrived at. There is, however, a consensus of opinion that the germ propagates in the womb and genital passages.

Bang, of Copenhagen, claims to have isolated an organism from cases of abortion, by means of which, after artificial cultivation, he has produced the disease experimentally.

There are some interesting facts in connexion with the experiments and observations made concerning this disease which have a practical bearing on its causation and prevention. One is that in the experimental production of the disease the abortion usually occurs at from nine to twenty-one days from inoculation, but the period may be lengthened if the cow

experimented on is in an early stage of pregnancy, or shortened if in a late stage. The period when abortion most often occurs is between the third and seventh month, so that if the infection is contracted at the time of "serving" it is evident that the period of incubation is longer than when it is conveyed experimentally, and hence no definite idea of the average period of incubation of the disease has been arrived at. The calves of aborting cows if born alive are usually delicate, and die of broncho-pneumonia or intestinal derangement within a few days of birth, and as they are undoubted sources for the transmission of the disease, it will be safer in all cases to destroy them at birth, and burn the carcasses along with the membranes and discharges.

Temporary sterility is a condition often associated with the tendency to abort. The cow takes the bull at frequent intervals, and fails to conceive. In the 1904 annual report of the New Zealand veterinary branch there is reported the case of a herd of thirty-two Shorthorn cows, the property of Archdeacon Williams, Te Aute, New Zealand, all of which had been barren for one to three years, as a result of an invasion of contagious abortion. In these cases there is apparently a chronic condition of catarrh of the womb, and if conception does take place, abortion occurs within a few months. Cows that have once aborted are very liable to abort again if they conceive, although in some cases it has been noticed that after two or more abortions the animal appears to acquire an immunity against abortion, and will carry her calf the full period, even though cows that have not previously aborted are aborting all round. In cases of repeated abortion in the same cow, it has been observed that the calf is carried longer each time, until the full term is reached, but the presence in the herd of an aborting cow is such a menace to the remainder that it is unwise to give such a cow the chance to acquire immunity. She should be fattened for the butcher, and cleared off the place.

PREVENTION AND TREATMENT.

The disease being transmitted by some germ which propagates within the womb and genital passages, every cow that has recently aborted, or that shows signs of impending abortion, ought to be regarded as a disseminator of the disease; and the consequent necessity of complete isolation of such animals from the remainder of the herd is self-evident.

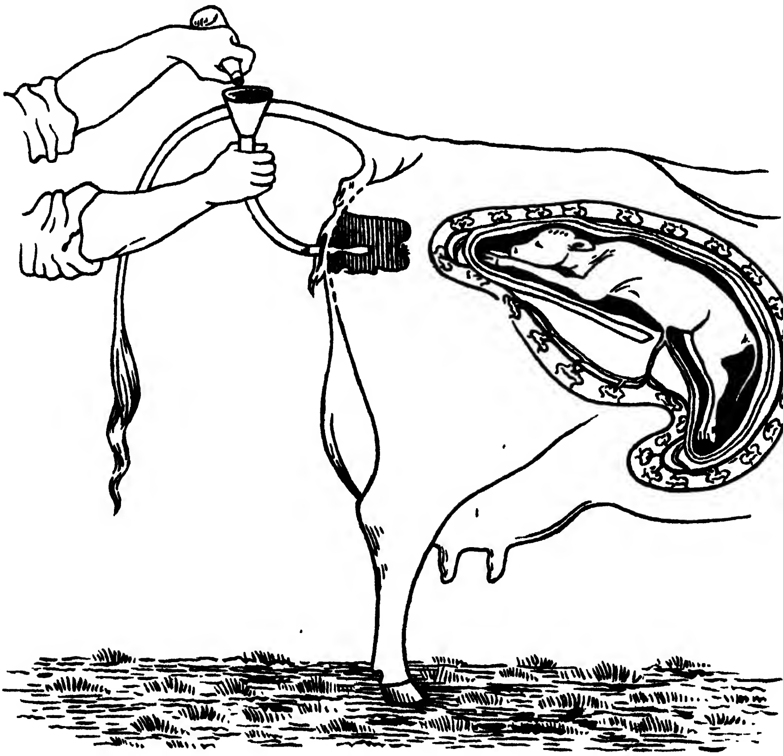
The success of the antiseptic or germicidal method of treatment will largely depend on the thoroughness with which the following details are carried out. As previously stated, the calf-membranes, and discharges, as well as all litter soiled by these, should be destroyed by burning. If the cow has aborted in the paddock it is absolutely essential that the fœtus should be searched for. If not found and burnt, it will certainly be "fossicked out" by other cows and infect them.

The womb and genital passages of the aborted cow should be irrigated with one of the following antiseptic solutions:—

1. Carbolic acid, 1 part; sodium carbonate, 1 part; water, 100 parts.
2. Creolin or Lysol, 1 part; water, 100 parts.
3. Corrosive sublimate, 1 part; common salt, 10 parts; water, 2,000 parts.
4. Biniodide of mercury, 1 oz.; iodide of potassium, 4 ozs.; water, 20 pints.

(No. 4 solution to be diluted 1 part to 20 of warm water when required for use.)

About a gallon of the antiseptic solution should be injected once daily for at least a week, and it is an advantage if it can be raised to blood heat before injection, so that the straining often induced by flooding with cold solutions may be avoided. An ordinary cattle enema syringe may be used, or a piece of hose piping may be inserted, and the solution poured or allowed to flow into it through a funnel, from a height sufficient to guarantee pressure enough to force the fluid into the furthermost recesses of the calf-bed. Where a number are to be injected, the solution may be kept in a barrel or vessel elevated on a framework, and the hose may have a pressure-cock attached to it, so that the amount of fluid injected may be regulated.



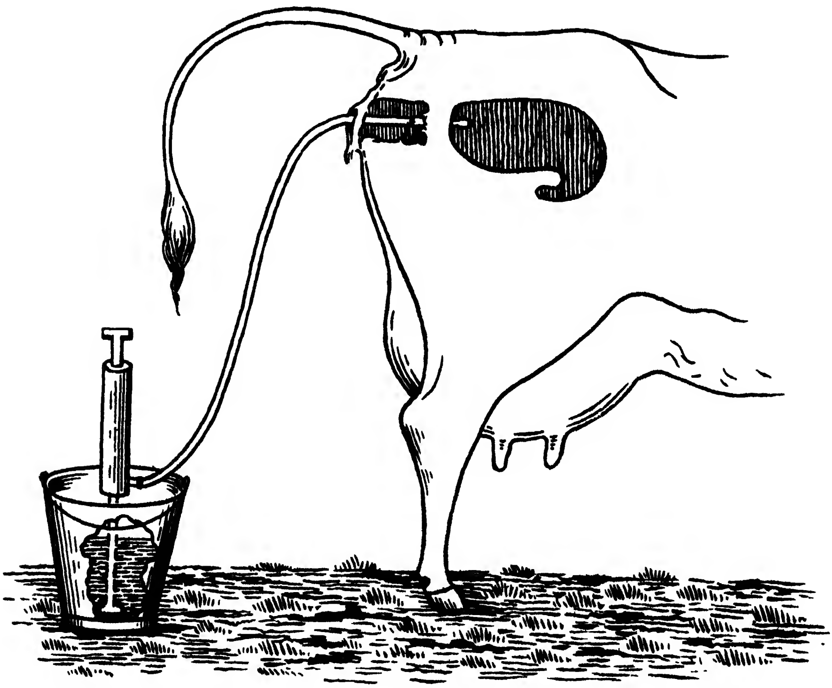
METHOD OF IRRIGATING VAGINA OF IN-CALF COW AS A PREVENTIVE OF ABORTION.

But the eradication of the disease will not be effected by the treatment of individual cows that have aborted, or even of those that fail to hold the bull. The whole of the cows, or at all events, all the pregnant ones in the herd, must be subjected to similar treatment, for it must be borne in mind that when a cow aborts the germ has probably been propagating within the genital organs for some weeks previously, and that long before abortion actually occurs such a cow may be a disseminator of the disease by germs passed out with the discharges from the genital passages. In injecting pregnant cows care must be taken that the fluid is not forced

into the womb, but only so far as the neck of that organ. One irrigation of pregnant cows will probably suffice, but until the outbreak has been completely overcome every cow in the herd ought to have the external parts and tail sponged daily with the germicide solution.

Aborted cows usually come "bulling" a few days after aborting, and, if then served, almost invariably abort again. Service should not be attempted for at least three months, during which time the germicidal treatment should be carried out.

The treatment of the bull that has been used with aborting or sterile cows is also an essential part of the eradication process. His sheath, and, if possible, the urethra of the penis, should be freely sluiced at



METHOD OF IRRIGATING UTERUS OR CALF BED OF NON-PREGNANT COW.

intervals with the antiseptic solution. To do this effectively, and without danger, it will be necessary to have the bull in a crush-pen, with his legs shackled, or to throw him. An ordinary human enema syringe, such as may be procured at any chemist's, may be used to irrigate the sheath.

Finally, cleanliness in the milking shed and surroundings is most important. The floors and lower parts of walls should be thoroughly cleansed at least once a week, and afterwards heavily sprinkled with bluestone (sulphate of copper) of a strength of 6 ozs. to the gallon of water, or some other effective disinfectant.

It is important, and will prevent discouragement, to remember that no treatment is likely to completely rid a herd of the infection in the course

of a single season, for when once a number of cases have occurred the disease is certain to be already in progress in the system of some of the remaining cows, although these may not at the time show any symptoms, and when the germ has gained access to the pregnant womb, no remedial or preventive treatment can be efficacious. The treatment above sketched out must, therefore, be consistently carried out for two seasons, and the fact that a few cases occur during the second season need not excite despair.

As indicating the enormous monetary loss that may be suffered by allowing the contagious form of abortion to spread unchecked throughout a dairying country, the following statements by Mr. J. A. Gilruth, M.R.C.V.S., chief Government Veterinarian of New Zealand, in an official bulletin on this subject, issued in 1905, may be quoted:—"I said last year that this disease was the cause of an annual loss of £100.000 to the Colony (N.Z.). In the light of the fuller information since received, I now assert that the loss is more than twice that sum." And again:—"Our experience shows that this disease is costing the Colony (N.Z.) from £200,000 to £300.000 per annum, an estimate based on the increased milk yield that would result from its eradication."

In Victoria, statistics as to the extent to which abortion and sterility prevail are not available, and estimates as to its prevalence in different districts vary considerably. Some herds are known to have been affected to the extent of 40 and 50 per cent., but an estimate of a 10 per cent. prevalence throughout the State would probably be very near the mark. Basing calculations on a 5 per cent. prevalence, however, it is found that the annual loss to the dairying industry through cows being out of profit from this disease approximates to a quarter of a million sterling.

Under the *Milk and Dairy Supervision Act.* 1905 contagious abortion is a notifiable disease, and it is anticipated that when the information that will be obtained as a result of notification is available, a comparatively reliable estimate of the prevalence of the disease in this State may be made.

Contagious Mammitis in Cows.

The prevalence of this disease amongst dairy stock in Australia was first announced in an address by the author before the Victorian Chamber of Agriculture at its 1905 Convention. Contagious mammitis has obtained a fairly wide spread throughout the dairy herds in Victoria, and is probably, in a large measure, accountable for much of the difficulty experienced by butter factory managers in maintaining uniformity of quality in their manufacture. This, because of the fact that the milk from one herd, or even from one cow, will serve to contaminate a whole "batch" of milk or cream, rendering it (as will be explained later) unsuitable for butter manufacture, on account of excessive acidity and curdiness. When the affection becomes at all wide-spread in dairying areas, the loss of the milking function of one or more quarters which the disease so often entails is a matter sufficiently grave to rouse reflections as to the serious financial loss the dairying industry sustains. The disease is also a grave one from a public health point of view, for in England and other European countries epidemics of sore throat and scarlatinal affections have been traced, beyond doubt, to the drinking of milk from herds affected with contagious mammitis. At Finchley (England), during an epidemic of sore throat, the germ of this disease was found in the throats of affected persons.

In New Zealand the affection has been the subject of thorough scientific inquiry by the Chief Government Veterinarian (Mr. J. A. Gilruth, M.R.C.V.S.) and his professional staff.

The CAUSE of the disease is a germ called the *streptococcus mammitis bovis*, belonging to the same family group as the ordinary pus-forming organism (*streptococcus pyogenes*), but possessing bacteriological characteristics by which it may be easily distinguished from the latter. One of these is that when introduced into milk it rapidly causes acidity and complete coagulation or clotting, within from eighteen to thirty-six hours, "the whole of the material becoming a mass of curd, with the smallest quantity of whey imaginable—a condition which, so far as I am aware, entirely differentiates this *streptococcus* from other organisms of the same germs." (*Gilruth*).

The disease is spread from farm to farm by the usual means of inter-farm traffic in cattle per medium of the sale-yard. It is suspected also that it may be taken on to a farm by means of contaminated separated milk received from a creamery or butter factory. If this is so, it furnishes one of many reasons why the milk of different owners should not be mixed at factories, and why the supplier should have only the separated milk from his own whole milk returned to him, or, alternately, it is a strong argument (as is also infection of bulk milk, by mixing, with tubercle germs) in favour of the sterilization of mixed separated milk at the factory before return to the owner. From cow to cow in the same herd the disease is spread by the hands of the milker, especially when the filthy habit of wet milking is practised, and when the milker's hands are not washed between milkings. The use of the milking machine is also a means of spread from cow to cow, it being next to impossible in practice to get the teat cups disinfected after the milking of each cow. Cows milked by machine are notoriously subject to sore udder (one herd may be cited in which 40 per cent. of the cows were so affected), and it is likely this is not so much due to mechanical effect as to the transmission of the germs of contagious mammitis by means of the teat cups. The infection from a diseased quarter to other healthy quarters of the udder of the same cow is brought about by the same means. On these points Gilruth's experiments were interesting and conclusive. They showed that, by ordinary milking methods, the disease was transmitted (within five days) to that quarter of the udder which was milked with the same hand as the diseased quarter. It would seem that the actual introduction of the germ into the quarter takes place through the orifice of the teat, whose surface has been contaminated by the germ-laden milk from the diseased quarter.

NATURE, COURSE, AND SYMPTOMS.

The disease is essentially a local one, confined to the udder, and the cow's general health is seldom appreciably affected. It is a slow, chronic form of catarrhal inflammation of the milk-bearing ducts of the udder. Three forms, or stages, of the disease are described, viz., acute, sub-acute, and chronic, in all of which the specific *streptococcus* has been found. These three forms may occur successively in the same cow, or any one of them may alone be existent.

In the *acute* form the onset is indicated by a diminution of milk yield from the affected quarter, followed by a tendency in the milk from that quarter to turn sour and coagulate much more rapidly than normal milk. A slight swelling or hardening of the teat duct may be felt, extending

up to the base of the teat, at which there is a hard fullness or nodulation. "Shortly after these early symptoms are exhibited, the milk becomes viscous, thick, and yellowish, being more of the nature of pus—which, in point of fact, it is—than milk. Gradually it assumes a dirty brownish tint, is more curdly, and if the material be collected and allowed to stand, one-quarter to four-fifths settles as a dirty brownish-yellow deposit, surmounted by a thin, pale milky fluid. The deposit, under the microscope, is seen to consist of masses of pus cells mixed with *streptococci*. Gradually the secretion of the quarter diminishes until only a few spoonfuls of the dirty-looking, purulent material can be removed, the teat duct becomes sensibly thicker, and if little attention be paid it becomes impervious, and the whole quarter rendered useless."

"The *sub-acute* form is in reality more dangerous than the foregoing, as the changes occur so slowly, and the secretion of milk is so slightly altered, that it remains frequently unobserved until too late, generally resulting in a 'blind quarter' the following year. Practically the only alteration observed in the affected quarter is a more or less marked thickening of the walls of the teat duct, the feeling being to the hand as if a piece of cord had been inserted into the canal. The disease is, therefore, purely local, and confined to the teat duct, and probably the floor of the 'milk cistern' or lactiferous sinus. Beyond the first small quantity of secretion removed on milking, the milk is little altered—so far as casual observation goes. The quantity first removed, however, is generally yellowish, curdly, and, in fact, purulent. This, however, is sufficient to contaminate the hand and the whole of the milk, and the remainder, passing, as it does, over the diseased catarrhal surface, carries away a further number of germs. Therefore, even if the first quantity be milked on to the floor, as is often done by the milker, the bulk is always contaminated to a greater or less extent."

"Gradually this phase of the disease is followed by the *chronic* form, which is manifested by the development of one, and sometimes two, hard nodules within the teat-duct, generally towards the base of the teat or its upper third. This nodule is usually about the size of a pea, though it may assume the dimensions of a walnut. This condition is sometimes spoken of by dairymen as a 'pea' or 'wart' in the teat."—(*Gilruth.*) Frequently the nodulated condition develops during the time the cow is dry, before calving, causing a previously sound udder to be blind in one or more quarters at the subsequent calving.

TREATMENT AND PREVENTION.

The treatment that has proved most effective up to the present has been the injection of boracic acid solution (1 part boracic to 20 parts warm water) into the affected udder through the teat-duct, by means of a metal teat tube and rubber syringe. About a quarter of a pint of the solution should be injected once daily, and a cure may be expected in the course of a fortnight if the case is in the acute form or early stage. For the chronic cases, where the teat-duct is "corded" or nodulated—"pea" in the teat—no treatment as yet carried out seems to be of any avail in restoring the normal function of the udder. It will be obvious that cows with sound udders should not be milked by the same persons who milk those affected; and further, that the milker's hands should be cleansed and disinfected (by washing in boracic acid solution, strong soda suds, or other antiseptic), not only between milking each cow, but also between

the drawing of each pair of teats, so that spread from one quarter to another may be avoided. In a small herd where only one milker is available, the affected cows should be left until the last. Milk from an affected quarter should be milked into a separate vessel, and subsequently boiled before being put to any use. It should also be superfluous to point out the advisability of examining the state of the udder, and of trying all the teats before purchase of dairy cows, with the object of determining the perfection or otherwise of the quarters.

GARDEN NOTES.

J. Cronin, Inspector Vegetation Diseases Acts.

The Camellia.

The camellia is a handsome ever-green, winter-blooming shrub, found native in China and Japan. The florists' varieties have been produced chiefly from *Camellia Japonica*, a species that was introduced into England from China in 1739. This species is described as a lofty shrub or small tree, found growing wild in woods partially shaded from the sun by other trees. Robert Fortune mentions several varieties that he saw in the Central and Southern provinces of China, which had attained a height of from 30 to 40 feet. Some time after the original importation, severals forms or varieties of *C. Japonica*, that produced flowers of varying colours and forms, were introduced into European gardens, and it was from these principally that the fine varieties now grown in our gardens were raised. In addition to *Camellia Japonica*, *C. sasanqua* and *reticulata* are worthy of cultivation, both of which species are included in the fine collection grown at the Melbourne Botanic Gardens. In this State the camellia is easily grown in the cool districts, where, when thoroughly established, it endures extremes of cold, heat, and drought. In the gardens in the metropolitan district, shelter from large trees or trellis is usually provided, and fine specimens may be seen in many of the large gardens and nurseries. In the warm districts, shade conditions are necessary to grow them. The principal point of value in camellias is their blooming when most trees and shrubs are without flowers or foliage. In a fair collection, embracing early and late varieties, some of the plants will be in flower from June till September.

Most of the plants purchased from nurserymen are grafted on seedlings from single varieties. This grafting requires a heated glass-house to insure success. Cuttings of some varieties will form plants under special conditions, but this method is not often practised, being very slow and uncertain. Layering is the most certain and easy means of increasing camellias. The process differs little from that recently advised for carnations, except that the soil should be more carefully prepared. The layers require to be attached to the parent plant, and attended to in watering, &c., for a full growing season at least. Some varieties need two years to form a sufficient root system to insure free, healthy growth in the young plants. In preparing soil for the reception of layers—practically cuttings only partly separated from the parent plant—no manure should be used. A light, sandy, and porous compost is necessary. The shoots should be securely

pegged down to prevent any chance of their being disturbed when cultivated. During spring is the best time to layer camellias, and free growing shoots of the previous season are most likely to make good plants. They require to be kept moist during dry, hot weather.

A fairly friable loam, enriched with well-rotted cow or sheep manure, and thoroughly drained, will suit camellias well. The best manure to apply to soil around large plants is bonedust. A light dressing should be applied, and lightly forked in during winter. A situation sheltered from north winds and full sun in summer is most suitable. In districts subject to severe frost a low situation should be avoided, or the flowers will be spoiled. At Wandin, the plants do well where lemons fail, owing to frost. In that district, too, they endure heat and bad cultivation, and in the proper situation, are as hardy as a laurestine.

DOUBLE FLOWERED TYPE.
"ALBA PLENA," WHITE.

SINGLE FLOWERED TYPE.
SEEDLING, WHITE.

One of the most important points in camellia culture is the need of planting carefully. The plants, if taken from pots, should be set out with the surface roots at the settled level of the surface soil. If planted too deeply they rarely succeed. Temporary shelter should be provided for the first summer, after which they may be expected to endure normal summer conditions. In cultivating the soil about camellias, deep working should be avoided at all seasons. Digging among the roots should never be attempted, as most of the feeding roots are near the surface, and would inevitably be destroyed. A light skimmering of the surface and a top-dressing of sweet, good soil is all that is necessary in the way of cultivation. The plants need a fair amount of water during summer. The only pruning needed is the removal of any parts that will tend to make the plants crowded with shoots, or ill-balanced. Black scale is common on camellias in Melbourne and district, though rare in country districts. An occasional spraying with kerosene emulsion or resin compound will rid the plants of this pest.

The principal varieties are as follow:—

Imbricated exhibition kinds:—White, "Alba plena," "Fimbriata," "Isabella," "Bonomiana," "Mathotiana alba"; red, "C. M. Hovey,"

"C. H. Hovey," "Rafia," "Mathotiana," "William Bull"; pink, "Storyii," "Mrs. H. Boyce," "Lady St. Clair," "Harriet Beecher"; marbled and striped, "Wrightii," "Giovanni Santarelli," "Carlotta Papudoff." Other forms:—"Aspasia," "Waratah," "White Waratah," *Sasanqua* and *reticulata*.

Flower Garden.

Digging, pruning, &c., should be completed without delay. This applies specially in places where a plentiful supply of water is not available. Before the warm weather begins, cultivation to conserve moisture should be well in hand, and the first step in that direction is the breaking down of the rough exposed surface left after digging. Pruning of roses and other plants should be finished early in the month. Deferring it will tend to check the plants initially, and afterwards to expose them to weather conditions calculated to reduce the vigor of the spring growth.

Ground should be prepared for annual and herbaceous plants. Last August special reference was made to the preparation of seed beds, sowing, &c. Shortly, the most important items are: Reduce the soil to a condition of fineness, sow the seeds very thinly if the plants are to flower where the seeds are sown, cover the seeds with light soil according to their size—large seeds, as lupins, to an inch; smaller, as pansy and phlox, merely cover. The soil should be pressed firmly over the seeds and watered lightly.

Divisions of herbaceous plants may be set out in their flowering quarters. The ground should be well manured for such as Canna, Helianthus, herbaceous Salvia, and others that make a deal of growth during the season.

A common query is—What is the best time to re-pot palms and suchlike plants? The need to re-pot such plants only arises when the pots are full of roots, or when the soil is sodden and sour. Spring is the most suitable time for re-potting plants used for room and table decoration. In a glass-house any time but winter is suitable. A mistake is often made by over-potting, *i.e.*, using pots too large for the plant. Slow-growing plants, like many palms, camellias, &c., should not be transferred to pots much larger than those they previously occupied. A move from a pot 5 inches in diameter to one 7 inches in diameter is quite sufficient. Rapid-growing plants, such as coleus, will need to be re-potted two or three times during the season. In potting plants only clean pots should be used; these should be well drained, especially if the plants are likely to remain in them for some time. Moderately moist soil, porous in character, and of the nature the plants require, should be ready for use. The plant to be re-potted should not be dry. After being removed from the pot the old crocks should be taken away, and (if pot-bound) the roots carefully disentangled. Some soil should be placed over the drainage material, and the plant placed on the soil a little below the level it occupied in the smaller pot. Soil should be added, and pressed firmly between the ball of soil and the pot until the required level is reached. Except in hot weather, the newly-potted plant will not require much water for a time, but will be benefited by an occasional syringing over the foliage, and extra shade. Pot plants fail often through being placed on exposed stands, at some height from the ground. The less the air circulates under and around the pots the better for most plants.

Kitchen Garden.

Where ground is in readiness, a variety of vegetables for summer and autumn use may be planted, or seed sown. From former sowings, onion, cabbage, cauliflower. and other plants may be transplanted. Seed may be sown of various roots, as carrots, parsnips, beet, &c., also peas and broad beans for seccession. Cabbage, cauliflower, and onion seed may be sown for transplanting later, and early potatoes planted. If a hot-bed frame is available, cucumber, melon, tomato, and celery seed may be sown for early use.

BLACK SPOT EXPERIMENTS, 1905-6.

D. McAlpine, Vegetable Pathologist.

Having been requested to test the efficacy of Little's Fluid Dip as a spray for Black Spot of the apple, I carried out experiments for this purpose at Mr. Hatfield's orchard, Box Hill, with the variety known as "Yates," which is rather susceptible to this disease. The trees chosen for experiment were, as nearly as possible, equal in size, vigour, and age, and the dip was used in two strengths of 1 in 120, and 1 in 160 respectively. Trees were left unsprayed alongside to serve as a check, and the following sprays were also used for comparison:—

Bordeaux Mixture, Phenoline (1 in 160),
Copper Soda, Crude Carbolic (1 in 160),
Phenyle (1 in 160), Oil of Tar (1 in 160).

The spraying was done at the end of October owing to the lateness of the season, and there was a sufficient development of Black Spot to allow of comparisons being made between the different sprays.

When the fruit was ripe, it was carefully weighed from each tree, and sorted out, separating the clean from the spotted. The details are given in the accompanying table, from which it will be seen that, while the unsprayed trees yielded 3.7 per cent. of absolutely clean fruit, those treated with Little's Fluid Dip (1 in 160) gave 3 per cent., and 1 in 120 gave 1.4 per cent. The result for this season was, that trees sprayed with Little's Fluid Dip had actually less absolutely clean fruit than unsprayed trees. Bordeaux Mixture and Copper-Soda yielded, respectively, 28.6 and 37.5 per cent. of absolutely clean fruit, while the marketable fruit—that not sufficiently spoiled to be unsaleable—was 99½-100 per cent.

DETAILS OF EXPERIMENTS.

Treatment.	Absolutely Clean.	Slightly Spotted.	Unmarketable. Badly Spotted	Total.	Per Cent clean.	Per Cent. Marketable.
	lbs.	lbs.	lbs.	lbs.		
Little's Sheep Dip (1 in 120) ...	½	33	1½	35	1·4	95
" " " (1 in 160) ...	2	63	1½	66½	3·0	98
Check	2½	61	4	67½	3·7	95
Copper Soda, 6.8.40	27	45	..	72	37·5	100
Bordeaux Mixture, 6.4.40 ..	25	57	½	82½	28·6	99½
Phenyle (1 in 160)	1¾	38	2½	41¾	1·6	94
Phenoline (1 in 160)	2	61	5	68	3·0	93
Crude Carbolic (1 in 160) ...	2	63	5½	70½	2·8	92
Oil of Tar (1 in 160)... ...	2	57	5	64	3·1	92

FOURTH CONVENTION OF THE VICTORIAN CHAMBER OF AGRICULTURE, JULY, 1906.

I.—IMPROVEMENT OF VICTORIAN PASTURES.

T. Cherry, M.D., M.S., Director of Agriculture.

There is no question of more importance to Victorian agriculture than that of the improvement of the pastures. In this lies one of the chief means of increasing the number of live stock that can be carried on any farm, and the number of live stock is the true measure of the agricultural resources of the State. Not only is it necessary to have good pastures to carry the live stock, but, as will be seen later on, the two go hand in hand. Rich pastures mean large herds, and, conversely, large herds mean rich pastures. In securing rich pastures, however, there are two factors—the soil and the rainfall; and, while our soils may be rich enough, the deficiency in the rainfall makes the question of improvement more difficult than it is in Europe or America. As far as Victoria is concerned, we must draw a distinction between the parts of the State that have a rainfall of more than 25 inches and those that have less. The 25-inch line begins at the South Australian Border north of Casterton, sweeps round the north of the Grampians to Hamilton, then passes diagonally to Mortlake, and thence along the railway line to Melbourne. From Melbourne it encircles the Keilor Plains, and skirts the hills round Ballarat to Clunes, and thence bears eastward, near Castlemaine and Heathcote, to Seymour, whence it follows the railway line to Wodonga. There is also a three-cornered part of the State, near Sale, with less than 25 inches, so that we may say that by far the greater part of the grazing land in Victoria has too little rainfall to make the establishing of permanent pastures an easy matter. Moreover, the same conditions make it difficult to get a good stand of pasture grasses, however carefully the land has been prepared. In Gippsland or the Otway country grasses and clovers will come luxuriantly after a burn-off, the seed being simply sown on the ashes, but few people have managed to make even a lawn successfully in many other districts. Another difficulty lies in the fact that none of our natural grasses are really good drought resisters—differing in this respect markedly from our shrubs. The shrubs nearly all have deep tap roots, while this characteristic is, I believe, almost unknown among the grasses. The attempts that have been made to lay down large areas with artificial grasses have not hitherto been very successful, outside the region of heavy rainfall.

To test what can be done towards improving our pastures at a moderate cost, the Department last year treated 30 pasture fields, of from five to ten acres each, in the following manner:- The field was harrowed, when soft enough, with a heavy straight-tooth harrow, so as to scratch the surface fairly deeply. Half-a-crown's worth of mixed clovers were then sown, and the same value in artificial manures applied in strips, as under—1, superphosphate; 2, potash sulphate; 3, bonedust; 4, gypsum; 5, Thomas' phosphate; 6, lime. Each plot comprised an area of about an acre and a quarter. As the edges of each strip of the manures were allowed to overlap by 20 feet, this arrangement gave us eleven experiments on the same plot.

All the districts of Victoria were represented except the far north, but the localities were chosen to represent the medium to inferior quality as far as the soil was concerned. Owing to the exceptionally unfavorable weather experienced last spring and summer, the results have not been so good as we might reasonably have expected, but reports from ten of the fields, received last March, show that sufficient has been achieved to warrant further experiments in this direction. In all these cases, the plots which have done best are those manured with superphosphate, superphosphate and potash, and Thomas' phosphate. In some cases the other manures have made a slight improvement, but often they have not. Several of the farmers report that the three plots above-mentioned are grazed much closer than the rest of the paddock, the superphosphate plot especially so. Mention is also made of the accumulation of the droppings from the cows on this plot. While the improvement of the native grasses has thus, to some extent, been accomplished, we have not had much success in establishing the clovers. Probably this is largely due to the unfavorable season. In cases, however, we have had marked success, especially with trefoil, cow grass, and white clover. For instance, on the field on the Salvation Army Farm, at Bayswater, on poor stringy-bark scrub country, the clovers are reported to be forming good large patches, which are spreading in such a way that the prospects of ultimate success are very good. I was led to try the effect of the clovers from the results of experiments in Europe and America, where it appears to have been proven that once this class of plants is well established, they not only improve the quality of the soil, but the ordinary grasses are able to follow them up and gradually form a good mixed pasture. As the work with these fields is being continued this year, I hope to have more definite results to present before you at the next Convention.

Before leaving the question of top-dressing for pastures, I may say that the general opinion among farmers seems to be divided between the value of superphosphate, bonedust, and lime. As bonedust contains about 20 per cent. of phosphoric acid, it will unquestionably have a good effect. Whether its supposed influence in lasting over several years, and in this respect being superior to the more soluble forms of phosphates, has any definite basis in fact, is a question that I hope we will be able to answer definitely in another year or two. Meanwhile, it is interesting to be able to quote a number of cases in which the application of superphosphate has steadily improved the condition of grazing land. For instance, Mr. Young, of Drouin, has a small paddock at the back of the town which has been dressed with superphosphate, at the rate of 1 cwt. per acre, for the last eight years. This four-acre plot carries four cows all the year round except for three months in winter, when a little chaff is fed in addition to the grass. Its capacity may, therefore, be stated at a cow to 1¼ acres. The surrounding land, cleared and sown with cocksfoot rye grass and clover about the same number of years ago, is carrying a cow to five or six acres. The deep, dark green of the one, compared with the lighter appearance of the others, may be seen a mile off. On walking across the adjoining properties, the usual Gippsland pasture, with here and there small, bare patches, is seen, contrasting strongly with the dense, thick sward on Mr. Young's paddock.

Reference has been made already to the fact that large herds mean rich pastures. In fact, the animal is an essential factor in increasing the stock-carrying capacity of any farm. The animal concentrates the phos-

phates on the surface, where they are within reach of the roots of the herbage. The solid and liquid excreta from each 1,000 lbs. live-weight of stock will, on the average, contain phosphates to the value of about £1 per annum. The richer the food, the more valuable will be the manure, but under our present conditions, and at current market rates, this estimate is probably well within the mark. Then, again, continuous grazing compels the plants to bring up more phosphates from the deeper portions of the land, and so increases the fertility of the surface soil. But there is another very important point about the solid manure of live stock. Large numbers of seeds pass through the alimentary canal without being digested; hence we find that, in the case of small seeds, such as clovers, this method is the chief way by which they are spread. This remark applies particularly to land with a hard, dry surface. The seed not only germinates readily in the dung, but it finds a good food supply at hand, and the soil immediately beneath is generally moist, so that the roots are able to penetrate the soil more easily. The fact that cattle and horses will not readily graze such patches for several months gives the young plants a better chance to establish themselves. Farmers who have been feeding meadow hay for a number of years know the importance of this factor in the improvement of pastures. In view of the difficulty of getting a good stand in even two or three seasons, and the expense attached to laying down grass land, my colleague, Mr. Cameron, suggests that it will be worth while feeding, for experimental purposes, a quantity of clover seed to cows, to see if the percentage that germinated in the dung is sufficient to pay for the cost of the seed.

Turning now from the natural pastures to the conditions that prevail on most Victorian farms, we are struck by the fact that since 1875 our live stock has, on the whole, increased, while during the same period four million acres of our best land have been brought under the plough. After making all deductions for the extension of ringbarking and clearing the forest, which marked the first work of the selectors, there can be no doubt that, acre for acre, we are carrying more live stock now than ever before, and I think there is evidence that the pastures in many districts are improving. The most noticeable improvement in the number of live stock, however, is in the wheat-growing areas, and this increase is due to the combination of cultivation and grazing. Without the breaking up of the land, the grazing would not be available. With the advent of the lamb trade many northern farms, of from 320 to 640 acres in area, are approximating to a rotation system. Wheat, oats, grazing, with a bare or a rape fallow, is the order in the most progressive districts. While the influence of superphosphate in making such a rotation possible must not be overlooked, still, what I wish to call attention to is this fact: It is the cultivation of the land that enables the seed to germinate readily, and which thus secures the additional grazing area already referred to. No such improvement is found on the northern areas, where the land has not been broken up. Here the stock-carrying capacity has undoubtedly improved, but not to the same extent as where the farmer also grows wheat or oats. The cultivated land allows of the speedy germination, not only of the wild oats and self-sown, but also of the trefoil and other plants that seem to come up spontaneously in the stubble. The growth of rape for sheep is another instance in point. Not only does this crop furnish food direct for the sheep, but it enriches the soil, because it helps, through the medium of the sheep manure, to transfer the phosphates and other elements of

fertility from the subsoil to the surface. Furthermore, the additional humus helps to increase the water-holding capacity of the soil. On the whole, then, it will be seen that, by means of cultivation, the wheat farmer has already, to a great extent, solved the problem of improving his pastures. He is fast abandoning the natural grasses. His rotation system compensates for the low average rainfall—a rainfall too small to allow him to dispense with cultivation. He is in a different position from the farmer in Gippsland and the Western District. The exigencies of the climate have forced him to adopt different methods, and, where seen at the best, those methods mark a distinct advance in Victorian agriculture.

Whether it will be possible, or even profitable, for the northern farmer to lay down land to permanent pasture is a question which has not yet been solved. At present lucerne appears to offer the best solution of the difficulty. When once established, its deep roots make it less dependent on the rainfall than most plants. It yields large quantities of fodder, very rich in the most valuable part of the food constituents, namely, the flesh-formers. When sown with superphosphate, and in a favorable year, it is more easily grown in the north than to the south of the Divide. Undoubtedly, it will form one of the mainstays of the irrigation settlements. Its weak points are that it does not stand grazing well, and that it goes asleep in the winter. Some farmers, however, obtain very much better results from lucerne grown without irrigation than others. My own opinion is that lucerne should be grown for hay each season, to allow it to bloom, and thus insure deep penetration of the roots. When grazed, lucerne should be heavily stocked for a few weeks, and then given a complete rest to allow the plants to make fresh growth. The first growth in spring is usually mixed with large quantities of other herbage, and should be made into hay or silage during the month of November. There is then sufficient moisture in the ground to insure a good, clean growth of almost pure lucerne, which should be allowed to grow until it is beginning to bloom. The paddocks should then be fairly heavily stocked during the summer, so that it is quite bare again at the time of the first autumn rains. If the animals have left any considerable amount of hard stalks destitute of leaves, it is a good plan to run a mowing machine over the whole paddock, allowing the stalks to remain on the ground. With the first autumn rains an abundant growth will then start from the crowns, and a clean-cut crown starts more effectively than one which has been bruised and injured by the teeth of the animal. The marvellous growth which lucerne makes in the spring and autumn is sufficient to justify its adoption by every progressive farmer. Lucerne is now being grown without the aid of irrigation in many parts of the north, where formerly it was considered impracticable to get a stand, and especially on sandy soils. There seems to be no reason why lucerne should not be profitably grown even in districts with the lowest annual rainfall. The difficulty often found in establishing a crop might be overcome by careful preparation of the seed bed, by planting the seed almost on the surface of the land, and by the use of superphosphates. The crop may be kept progressively improving in condition by scarifying it once a year, and by the application of at least ½ cwt. superphosphate to the acre. Whether prairie grass may be profitably combined with it, so as to insure good growth during the winter months, is a matter that requires further investigation.

So long as farms are as large in area as at present, it may be argued that crop, grazing, and fallow form the most practical solution of the pro-

blem. If such prove to be the case, it simply means that the natural pastures are doomed to speedy extinction in the north, for the sooner a rotation is adopted, that only allows of one or two years' grazing, the sooner the land will be turned to its most profitable use. A somewhat similar system of rotation is seen in the dairy farms at Koroit, where potatoes, oats, barley, and peas are worked into a scheme that usually provides for three years' grazing or more, according to the size of the farm. In Gippsland, the preliminary work has not yet advanced to an extent comparable with the Western district, but indications point to the fact that the best way to keep the steep hills in good grazing condition is by the application of superphosphate. The spread of clovers (and in wet places the strawberry clover is making rapid headway) augurs well for the permanence of our pastures in districts where lucerne cannot be grown. The three factors, live stock, cultivation, and superphosphates, all tend to the rapid improvement of the Victorian pastures.

II. SOME LAW.

J. Weldon Power, Horsham.

The practice of lecturers of introducing the subject of the lecture by prefatory remarks descriptive of its general character, and of the various sides it may present for observation, is so general as almost to amount to a law in itself. Being a lawyer, I feel I ought not to fly in the face of precedent. Law, however, is so huge a subject that if I were to start with a preface the time available for my paper would be exhausted long before I could get through. Therefore I have entitled my paper "Some Law," so that I may evade the preface and get down to business right away. My reason for offering this paper is that farmers run up against law in their everyday affairs just as often as most people, and it occurs to me that a few hints on how to get through with some of the matters of business that farmers have to deal with now and then would be of material use to them.

At our conventions I have, from time to time, listened to most admirable papers suggesting means and devices for increasing the productiveness of land and stock. A hint how to make a cow that yields a profit of £9 bring up that profit to £10 is worth knowing. Now, it is a very small piece of litigation indeed that will not run, not only to £1, and the whole £10, too, but to a fair slice of the whole herd. A man is sometimes faced with the proposition, "Must I go to law over it, or had I better put the loss and annoyance in my pocket and grin and bear it?" The loss may be that of a good bargain over a well-bought piece of land, a loss worth many cows, and a man must make up his mind to make the loss or face the risk. The unscrupulous man knows this, and, relying on the horror the average saving man with money to lose has of law, he swindles him out of his rights, and then only thinks and openly boasts many times that he is only showing "savee" how to get on. If I can give you a hint or two how to be ready for that sort of customer, it may prove worth a cow or two, perhaps.

It may be that farmers in other parts of the State know more than litigation in the Wimmera district shows me that farmers know there, and

I may, as far as this paper is concerned, be, so to speak, "teaching my grandmother how to suck eggs"; but I do not think it likely, so I will get along. I do not propose to teach you any law, nor do I address this paper to lawyers. I do not wish you to understand that what I say covers all the ground on the points under discussion. Particularly, I do not want you to assume that you can go to law right away if any matter you have worrying you seems to fall within the few rules I will mention. I want you to understand that I am only giving you hints about the law upon, and the way to go to work to carry through, the classes of transactions I will refer to. I will only say this much: if you keep what I say in mind, and stick to it, you will pull through your future transactions of these classes with satisfaction to yourselves and a minimum of risk and loss.

To begin with deals and bargains with your neighbours. There are some bargains that must be in writing, and be signed by the other party, if you wish to hold that other party to his word—and just in the same way such a bargain must be signed by you if the other party wishes to hold you to it. If he signs and you do not, you can hold him, though he cannot hold you; and if you sign and he does not, he can hold you, but you cannot hold him. This may seem unfair and one-sided: but if the law be that this class of bargain must be in writing, and be signed, it is your own fault that you omit to get the writing and his signature. And it is his fault if he does not look after himself. Remember, however, you cannot in such a case eat your cake and have it. If he sets out to hold you to it, he must stand by it himself. The only thing is, if you have not the writing with his signature to it, he can tell you when you call on him to go ahead, that he has changed his mind, and that is all there is to it. You have no redress. Of this class of bargain is every bargain relating to land or interests in land.

As far back as the days of Charles II., of merry memory, the well-known Statute of Frauds was passed for the purpose, as the Statute itself says, of "the prevention of many fraudulent practices which are commonly endeavoured to be upheld by perjury and subornation of perjury." One of its provisions was in effect that you could not enforce by action at law a bargain to buy or sell land unless the terms of the bargain were written out, and bore the signature of the party to be held to it. The particular evil that seems to have been aimed at was the practice of going to court to prove false word-of-mouth bargains for sale or purchase of land, and buying witnesses to forswear themselves, and swear to the truth of the alleged bargain. This was, no doubt, a nice state of things, and shows that some of our forbears were pretty unscrupulous operators in the land booming of those days. There was a rough and ready simplicity and directness about their methods. Get a man to talk about his land, and then palm off an alleged bargain on the Court, and buy half-a-dozen or a score of professional witnesses to swear up to the hilt. You see the scoop to be made enabled the operator to buy the aid of the witnesses. Land was then, as now, a valuable thing, and it was the very fact of its value, and the profit that could be made, that suggested the operation, and provided the means of carrying it out.

The Statute required the bargain to be in writing, and the signature to it of the party that is to be held. A common idea is that to bind a sale of land there must be a deposit of money or money's worth, such as a cheque, and that if there be such a deposit the bargain is binding, whether there be writing or not. No, the deposit has nothing to do with the

binding. The net effect of the act is that if a vendor agreed with a purchaser to sell a piece of land, and took deposit of half the purchase money, and there were fifty people present to swear to the bargain and to the payment of the deposit, and there was no writing signed by the vendor, the vendor may return the money, and refuse to go on with the deal. It does not even matter if, in the presence of the fifty witnesses, the purchaser paid not only a deposit, but the whole of the purchase money-- paid it in bank notes, say, and every one of the fifty witnesses kept tally of the numbers of the notes, and the general manager of the bank came to swear the purchaser himself paid those very notes in to his account --it would be no use. The vendor could decline the deal, and stick to his land by returning the money. You see, it is not a question of proving what the bargain was. The fifty witnesses could do that. It is not a question of the effect of paying a deposit, or paying the purchase money. That cuts no ice.

The matter stands this way, that to put a stop to the outrageous swindling and false swearing that used to go on where word-of-mouth bargains were permitted with such a valuable thing as land, a law was passed declaring that the help of the law courts will not be given to enforce bargains relating to land unless the bargain be in writing. The reason is twofold - first, because to go through the formality of writing out the terms of the bargain and signing it shows that the party who signed really agreed to the conditions; and next, because the writing tells the story of the bargain, and cuts down ground for dispute and misunderstanding. No doubt it appeared to a certain class in those days as much an interference with the liberty of the subject to come in with a law of that kind as it does to certain persons to-day when a law is introduced to prevent milled butter being put on the market with a fancy factory brand, all beautified with buttercups and daisies and copper churns, till the purchaser can almost see the fairy factory set in the choicest flats of the Gippsland rivers, instead of being stuck away in a back slum of a filthy suburb. The underlying motive is the same- to stop swindling; and the good sense of the people as a whole accepted it.

I must now call a halt to say that there is an exception to the rule that the bargain must be in writing, with which I will deal later, and to give some hints about the writing.

The first principle about a written bargain is that once it is written out and signed no explanation or excuses will, generally speaking, be accepted. The writing stands, and neither party may go outside it to give evidence in the box that this, that, or the other, not set out in the writing, was promised or understood at the time. There are several exceptions to this rule, but take it as safe and reliable advice from me that if there be any promise or so-called "understanding" about the deal, get that promise or understanding into the writing over the other fellow's signature, if you want to rely on it. For instance, you go to a man to buy a farm, and find him on the boundary supervising a contract for putting up a wire netting vermin-proof fence along a 2-mile boundary, with the netting and new posts and wire all along the line, and they are just pulling an old brush fence out of the way. He says he will have it completed in three weeks. You offer him £10 an acre, and he replies, "Why, the new vermin fence that I will have finished in three weeks will put another 5s. an acre on the land." You say, "Oh, well, I'll give you another 2s. 6d.," and you finally close at £10 4s. If you do not put in the writing that

the fence is to be completed by him you are up a wattle, and you cannot even make him put back as much of the old brush fence as he may have pulled off the line to make way for the fence you really gave him the extra 4s. an acre for. If on top of that bargain you go and sell your own farm to enable you to complete your deal with him, you are only deeper in the mire. The safest way to go into a deal where there is writing is to regard it as though you gave up or gave away everything you asked the other man to do, everything he told you was good or advantageous about it, and which he told you he would do if you bought, which you do not get into the writing itself. For instance, if you had fifty people to swear that he promised you if you could not pay an instalment he would hold it over for twelve months it will avail you nothing. It is not in the writing, and you cannot go outside that. If you bargained that you would be at liberty to cancel the deal within one month by paying a forfeit of £100, and you had a dozen justices of the peace to swear that he promised to declare the deal off on those terms—but it is not so set out in the writing: —no good. Neither you nor the witnesses will be allowed to give that evidence. You must stand or fall by the writing. The reason is simple: What is the good of the writing if a man be allowed to supplement it or contradict it by word of mouth? You might as well have it all by word of mouth. The common mistake is that people think the courts may listen to evidence to prove what was really promised, or, as the usual phrase goes, "was understood at the time." No; the law will only allow the courts to look at the writing.

This same rule as to writing in connexion with bargains in relation to land applies to all bargains when reduced into writing, whether relating to lands or chattels, to a greater or less extent; but the safe rule for laymen is to regard it as applying to all bargains in writing to the fullest extent. Particularly is it so regarding bargains in writing made with agents and canvassers. Every order you sign for an agent is a bargain in writing. You will find a canvasser ready to guarantee by word of mouth—and a wide mouth at that—that his plough will turn a 6-in. furrow through a metal road with a team of 14-hand ponies, and if you give it a trial you can return the implement right away if it does not give you complete satisfaction. Or perhaps it may be the case of a drill. He will guarantee —still with the wide mouth—that his firm's latest improved system of feed will break up and sow manure that has been lying for a fortnight on the open station platform—the railways not running to tarpaulins for manure these times—just as well as the best and driest conditioned superphosphates, and he will take the drill back if it won't, and you give him a signed order on that promise. You will find that the plough will not bury the weeds in a paddock that has been cropped for the past twenty years, and would burst up a team of traction engines to haul, or that the drill will not sow grain, let alone manure. No use, you are done. A smart canvasser and a farmer had business together, with the inevitable result. If you got the recording angel to come and testify that he was by and heard the agent promise and make a note of it at the time —no go. Neither you nor the angel will be allowed to give that evidence. The writing must tell the tale. What is not in the writing cuts no ice. Remember, whatever the canvasser says he will guarantee about the implement: whatever promises he makes about your having to be satisfied with it, get that in the order before you sign. If you stick to that rule there will be less orders signed and fewer disappointed agriculturists.

Don't be stalled off by the old bluff, "Do you doubt my word?" Why give him your signature and you put up with his word? Why, look at pretty well all the so-called orders you are asked to sign. You see that most of them from the better class of business people have printed on them in the margin a formal notice that the vendor will only be responsible for the warranty printed on the order. What do they put that there for? Honest people put it there as a warning to customers that the agent has no authority to guarantee or warrant anything not printed on the order. It was not long till the smart operator played over that game. He puts it on, knowing very well his agent will be smart enough to keep it out of sight of the purchaser, and then what a trump card it is as an answer to the poor purchaser's story that the agent gave the glowing guarantee that really got the order.

Look at everything you sign, back and front, and read it patiently, and when you do sign, sign close to what is written or printed, and get a duplicate of it to keep for yourself. You will want it nowadays. If the business won't stand that, have nothing to do with it. It shapes crooked from the moment the other man wants to take your signature, and will give you word of mouth only. So much for the writing.

Other classes of bargains that sometimes must be in writing and signed by the other man, if you want to hold him to them, are sales or purchases of goods and chattels of the value of £10 and upwards. Chattels mean all sorts of movable property, such as grain, hay, growing crops, live stock, produce, as well as articles of furniture and so on. Bargains about this class of property at £10 or more must present one or more of these three features if you want to hold the other man, viz.:—1st. They must be in writing, and be signed by him; 2nd, there must be payment, or payment of earnest money, even a penny, or less, if you can get it, will do; or 3rd, there must be delivery, though delivery may be of a portion in the name of the whole. For instance, if you want to buy a horse from a man, and shake hands in the presence of a dozen witnesses over the deal, at £15, and tell him you will come round in the morning for the animal, and you do come round with the fifteen sovereigns, he may please himself whether he goes on with the business or tells you he has changed his mind. No one of the three things I have mentioned was present.

Suppose you want to sell a line of wheat for forward delivery, and you produce a fair sample of how it is going, and agree to sell to a man. He agrees to buy, and you close with each other, and you say you will start delivering that day fortnight. When the first load comes in he may please himself. If wheat has gone up you may find shuffling, or you may find an honest man. If you want to be sure to find the honest man, have one of those three things I have mentioned. Have writing, have delivery, which you can do by handing him a handful of the sample in the name of the whole line, or have him pay some earnest money. But delivery of that kind and payment of earnest money are not to be compared with writing. He may be dishonest enough to deny both, and unless you have witnesses you will get left. The writing is the simple way, and it sets out the price and the quality, and so on. And once more, get it all in the writing. If say, you are selling for forward delivery, and you think you will have between 900 and 1,000 bags, but are not sure, don't let him put in 1,000 bags; get it in as the crop to be harvested off such and such a paddock of so many acres. You may have a hailstorm before you get back. If your writing says about 1,000 bags, well, it has got to be "about" 1,000

bags; 900 won't do, and if the hailstorm leaves you only 500, and wheat goes up, you will have to face, not only the loss of your 500 bags, but will have to pay the advance in price of the short delivery.

As far as sales for forward delivery are concerned, I want to say this—If you want to guard against risk you must make the deal as of the crop growing on particular paddocks up to so many hundred bags. If you and the buyer have a talk, and you say, I reckon to get 2,000 bags this year, and I am willing to sell you now 1,500 bags for delivery in February, and he says all right, what you do nine times out of ten, is to sign a sale note to the buyer of about 1,500 bags of f.a.q., or, perhaps, prime shipping. Then you have to deliver "about" 1,500 bags, and it does not matter if the rust attacks the crop, and you don't get 1,500 bushels, you have simply agreed to sell him 1,500 bags, and though you had in your mind, and he knew it, the particular crop, yet that won't help you—it is not in the writing. When you sell a particular crop, specify the land on which it grows, then if disaster comes and destroys it, the bargain lapses at the wish of either. That is, the buyer need not pay, and he cannot force you to deliver. The basis of the bargain was that there should be a certain quality of crop to sell, and if Providence in this particular case takes a hand, then the crop that was contemplated does not come into existence at all.

About Sales of Stock.—Never take a man's word that an animal is sound and free from disease or vice. If you pay on his statement to that effect, and it is not in the sale note, you have no redress. Get it in the sale note as warranted sound, and so on. In these days, when inspectors are liable to come along, and order the destruction of animals, it is a wise thing when you buy a beast that may have come from suspected country, to stipulate that it is free from disease. It may not be worth while to bother, but if it be worth while to ask for his word, then it is good enough not to touch it if he won't put it in the sale note. Hold out for the word warranted. If you get the word warranted in, then all you have to do is to prove that the beast is not as warranted. If the word warranted be not there, then the chances are you will have to prove not only that it is unsound or diseased, but that he knew it was so.

Now to come back to bargains about land. For practical purposes the only exception to the rule that the bargain must be in writing is where you get or give possession under a word of mouth bargain or contract. This is called "part performance." In such a case the terms of the bargain may be proved any way you can, whether by writing or by witnesses in the box. Before touching on what you ought to look out for in the writing, I may say this about agents for sale:—Unless the agent holds the signed authority in writing of the vendor to sell or the purchaser to buy, he has now no power to bind the vendor or the purchaser. If an agent relies on the word-of-mouth instructions of a man to sell his land for him, and does sell it and signs the sale note, the vendor is not bound, and the purchaser cannot get the land if the vendor backs down. The purchaser's only remedy is to sue the agent for the loss of the bargain. I need not waste time telling the agents what to do. I am not flat enough to give a lecture to them. Therefore, if you deal with an agent, ask for his authority in writing if you want to make sure of the land.

Well, to come back to the contract. First of all, if you intend to have a solicitor to do what is called the "legal work" for you in connexion with

the matter, go to him before you sign anything. Be satisfied that the bargain you intend to make is fairly set out in the writing, and that none of the conditions is unfair. It will be too late after you have signed to object to the conditions. By far the most important service a solicitor can render to you in connexion with the matter is his advice as to the nature and effects of the document. If it be a sale by auction of one of these speculative private closer settlement estates, look out. You want to buy with freedom to sell again if you get tempted, and you want in your turn to have a title that won't frighten your man.

Stuck away in printed conditions may be a clause to the effect that no objection or requisition shall be made because of a certain mortgage further than to require that it be paid off when the balance of your purchase money falls due. You are thinking of going £15 an acre for the land, say, and you are told, "Oh, that clause is about a mortgage for only £25,000, equal to £5 per acre, and has five years to run, and the mortgagee won't hear of taking his money; £5 per acre of your purchase money is to remain outstanding till the due date of the mortgage, and then the mortgage will be paid off at the same time as you pay up." As you will still have to pay £5 an acre for your land, everything in the garden seems lovely, and you are satisfied. But it is bad business, and your title will be shied at you if you want to sell in your turn and your purchaser is cautious enough to have his contract seen to by his solicitor. The mortgage of £25,000 is not charged at per acre on the land. It is not £5 that is on every acre, but £25,000 is on every acre. That is, every inch of the land is responsible for the full loan. Your land will be the pick of it, no doubt. If the vendors get £15 an acre for half the land, and £5 an acre for the other half at the auction sale, it shows £50,000, good cover surely for a mortgage of £25,000, and things look satisfactory. But when the time for settlement comes the whole land stands for the loan. There are the 5,000 acres and the £25,000. If every purchaser pays up and the vendors are honest, there is enough to pay the mortgage. But suppose the vendors have been swindled by their manager, who has bolted with the cash. Suppose the land market falls a bit. That half that was bought for £5 when you bought your lot for £15 may now be worth only £4. Several purchasers may be unable to pay up. What will happen then? The mortgagee will sell the land, including yours, and you will get a dividend no doubt of more or less in the pound. That is not a fancy picture. It has happened before, and will happen again, and men supposed to be smarter than farmers have fallen in. Never buy a lot of land that is subject to a mortgage jointly with other land, unless there be a condition in the contract that the mortgagee will agree to the sale, and will give title on compliance by you with your payments under your contract. Let the vendor and the mortgagee arrange that between themselves. Let them trust one another.

Another thing, many people buy land on terms, and give promissory notes for the balance of the purchase money, and sometimes a transfer is signed to be held in trust till the purchase money be paid, but oftener not. Well, that is a bad system too. By far the safer way is to get the transfer right at once, and give a mortgage back. The purchaser is no worse off, but better off. The mortgage may sound bad, and you may feel freer without it, but it is safer and better and simpler than the other way. There are

several reasons for this. If you pay a good deposit, and are unable to see your speculation through, that deposit is invariably absolutely forfeited, if you are working under the promissory note system, and too often the vendor has under the contract the right to forfeit the purchase money paid to date. Then, if you fail, the vendor can stick to the land as well as the deposit, or he may slaughter the land to an accomplice, and turn round and sue you for the deficiency in price caused by his slaughtering sale. Moreover, you may have a difficulty in getting title at the finish. There are many ways in which you may be exposed to risks, not far-fetched either. If you get a transfer and give a mortgage, you eliminate all risks between you and your title except the one risk of whether you will be able to pay or not. You get the full benefit of your deposit If you get hit later, the deposit cannot be forfeited against you. Moreover, if the mortgagee forecloses on the land, he cannot sue you for the mortgage money afterwards, and he cannot foreclose on the land if it be under the Transfer of Land Act, as nearly all country land is, unless he first offers the land for sale by public auction, fairly advertised, and if there be a surplus you get the benefit of it, which you would not the other way.

Another clause that is in almost every printed contract of sale is that forfeiture clause on default by purchaser. You often see in contracts the conditions of Table A are to apply. Now, the forfeiture condition of this table is an iniquitous one, and I have often wondered that it was ever allowed into the Act. The conditions of Table A are intended for general use as being reasonably fair between buyer and seller. This condition, if a buyer makes default, enables the vendor, without any notice, to cancel the contract. This is most unfair, and no sensible man should sign it. Always have that clause amended to provide that the vendor cannot cancel without first giving you reasonable notice, say, fourteen days, to put yourself right. Another unfair condition of Table A is that enabling a vendor to annul the sale practically at his whim if you raise objection to his title, that he ought fairly to answer. This condition is often shamefully abused, and a vendor takes advantage of it to declare a sale off. Another is the condition that provides if the purchase money be not paid to the day the purchaser will pay 8 per cent. interest. First, the rate is criminally high, and next, the delay is caused as often as not by the vendor; yet the purchaser has to suffer. These things should be seen to.

About wills, the best thing I can tell you to do in this connexion is—Get your will made at once, and get a responsible solicitor to do it. The law makes in its own way a fair enough division if there be children—one-third to the widow, two-thirds to the children—but the expense of obtaining administration when a man dies without a will is much greater. There are two points about wills every one ought to know. First, when you marry there and then all wills made before marriage are instantly revoked and fall to the ground. Second, it is fairly well known that, generally speaking, a will is revoked by a later will without the new will saying anything about revoking. It is always so revoked, unless the scope of the later will clearly shows that it is supplementary to the first will. A common mistake is that if a man revokes a second will, as by cancelling his signature or tearing up or burning the second will, then the first will will operate. No, the first will was wiped out by the second, and does not revive. If you want to revive it you must re-execute it.

III.—THE ANALYSIS OF SOILS AND MANURES: THEIR UTILITY TO THE FARMER.

F. E. Lee, Agricultural Superintendent.

Among the many benefits that science has rendered to the farmer, there is perhaps not one which has a more important and practical everyday application than the analysis of soils and manures. The value, however, of soil analysis is sometimes exaggerated by the agriculturist, who sees in the statement that his soil contains so much percentage of the various plant foods the possible solution of many of the difficulties he experiences in producing maximum crops. That the chemical composition of the soil, and also of all the vegetable products derived from it is of the very highest value as a guide is not denied, but until the farmer realizes that "fertility" means something more than the mere presence of plant food in a soil the best results and maximum amount of assistance cannot be gained by the medium of soil analysis.

In the true sense of the term, the fertility or in other words the productive power of a soil represents the harmonious working together of a number of factors, all of which are interdependent. All vegetable life, whether cultivated crops, grass, or forest trees, must breathe. The same life depends on the store of moisture at the disposal of the plant. The temperature of the soil exercises a highly important influence on vegetable life, and at no period is this factor more observable than during the germination of the seed. The penetration of the roots of all plants depends on the measure of resistance that is offered by the soil. The effect of shallow cultivation or of cultivation conducted always to the same depth is responsible to a great extent for the confinement of the roots within a limited sphere. Lack of opportunity to expand and elaborate an abundant root system will be found to be as often the cause of poor crops as the absence of plant food.

A proper system of drainage, either natural or artificial, is by no means the least of the factors which influence production. The removal of surplus water by drainage permits of the circulation of air, and thus tends to improve the warmth of the soil. In a badly drained or water-logged soil, the surplus moisture can only be removed by surface evaporation, and as this means is only slow, it is not surprising that farmers find crops grown on wet soils slow to respond to the genial climatic conditions of spring.

The presence of plant foods in the soil contributes to the well-being of the crops grown upon it, but it is nevertheless a well-established fact that all the elements of plant food may be present, and yet the soil may be quite unproductive. How can this be? The answer is quite simple, and examples in support of this statement may be found in many parts of Victoria. The proper conditions of drainage, air, warmth, &c., are absent, and the inharmonious working of these controlling factors of fertility prevent such soils being profitably cultivated. It is only necessary to call to mind the large tracts of land in the State which are lying unproductive to-day, owing to the imperfect conditions of drainage which prevent anything but a growth of coarse sword grass, reeds, or

grass tree. Take, for instance, the land in the Heytesbury Forest area, familiar to many of those present, as a barren, worthless tract of country. Yet the analyses of three representative samples of soil from that locality show it to contain, if anything, slightly over the average content of nitrogen—for the coastal plain districts; it is low in phosphoric acid, and particularly poor in potash, but considered purely from a chemical point of view, the Heytesbury Forest land should be as productive as many other districts. Why then is this land unproductive? The whole question may be succinctly answered in two words—"bad drainage." Here, then, is an example of where a chemical analysis only is misleading if sole reliance were to be placed upon such means to determine the producing power of a soil. Let us turn for another example to the Mallee soils in this State; we find, by chemical analyses of these soils, that they are comparatively low in nitrogen, poor in phosphoric acid, rich in potash, and superabundantly supplied with lime. From a purely chemical stand-point, the Mallee soils appear ill-balanced in plant foods, and there would be every justification for an inexperienced agricultural chemist to recommend the addition of manures containing nitrogen to the usual phosphatic dressing. It is to the experimental field work that the northern farmer owes the convincing demonstration that the addition of nitrogenous fertilizers not only increases the cost of application, but may even lower the yield of grain.

THE STANDARD OF A SOIL OF GOOD FERTILITY.

Soils.	Analyses.	Parts in 100,000 of Soil.				
		Nitrogen.	Phosphoric Acid.	Potash.	Lime.	Chlorine.
		200	150	250	400	Not more than 35.
Top Soil—						
Northern Plains ...	34	112	61	422	1,072	9
Coastal Plain... ...	85	178	61	185	903	7
Mallee	5	113	47	380	2,426	7
Volcanic Soils ...	24	272	61	277	588	17
Clay Soils	30	149	63	205	176	10
Drained Swamps ..	8	750	76	263	315	40
Sub-Soil—						
Northern Plains ...	34	89	60	706	2,487	20
Coastal Plain... ...	85	106	46	247	380	13
Volcanic Soils ...	24	103	42	170	1,649	6
Clay Soils	30	100	66	232	155	8
Drained Swamps ...	8	191	31	154	121	19

Many instances may be quoted of where a purely chemical analysis of soil is as likely to be misleading as not. My hearers will begin to ask themselves, have they, after all, been living in a fool's paradise in placing this implicit confidence in soil analysis? My answer is—Not at all. Soil analysis has played and always will play a highly important part in agricultural affairs, but the solid fact must be grasped by all agriculturists that the presence of plant foods is only one of the factors which control production—an important one, and a fundamental one, but nevertheless not the only one. There is, however, one aspect

of the question of soil analysis that has been patent to the expert officers of the Agricultural Department for many years, and it is this:—The standard which we have adopted for the purpose of comparing the analyses of Victorian soils with others is an arbitrary one which requires modification for localities having different climatic conditions. A comprehensive soil survey of the whole State would involve enormous expenditure, and would engage the exclusive attention of a large staff of trained analysts for many years to come. In my opinion what would be of immediate benefit would be the commencing of a regular and systematic collection of every type of soil within the boundaries of the Wimmera, Mallee, Goulburn Valley, North-Eastern, Central, Western, and Gippsland districts. Land-holders could be invited to lend assistance to the Department in procuring representative types, and a uniform plan for the taking of samples could easily be devised. It might be asked—what is this but a soil survey? Of course, it is a soil survey to a certain extent, but instead of land-owners being compelled to wait, perhaps a decade or more, for information, the want of which is urgently felt at the present moment, some definite information would be revealed within a reasonable time, and at a fairly moderate cost. What we want, in my opinion, is something akin to the Bureau of Soils, which is a well-defined branch in the United States Department of Agriculture. Time will not permit me to go minutely into the details of the suggestion, but I may be permitted to say that until some amendment is made in our present system of soil analysis, much of the valuable work that is being done in that direction will be wasted for lack of uniformity, and may have to be done over again. I respectfully commend the suggestion to the Chamber of Agriculture, confident that the knowledge of the important principles involved and the practical utility of such work will be sufficient to insure its thorough investigation.

THE ANALYSIS OF MANURES.

So widespread has the use of artificial manures become within the last few years, that it is not surprising to find a much better appreciation of the value of the chemical composition of these aids to production than prevailed a few years ago. The competition for the farmers' favour has had the effect of keeping up and even improving the quality of artificial manures every year. Vendors of an article containing a high content of plant foods are quick to draw attention to the chemical composition and commercial value of the article supplied by a rival firm—if inferior to their own. The necessity for the presence of a label setting out the analysis of the contents on every bag of manure sold, under the provisions of the Artificial Manures Act, has done much to impress the farmer, and incidentally to educate him in the direction of the chemical compositition of manures. Nowadays the purchaser of artificial manures has only to refer to the published list of sworn quality, price asked, and real value, for every fertilizer vended in the State, which is to be found in the *Journal* of the Department of Agriculture. From time to time there are also published in the same *Journal* the analyses of manure samples, taken by officers of the Department, in the country, during transit, or on the farm. These safeguards assure the protection of the purchaser from a spurious or adulterated article. There is nothing to

the provisions of the Manures Act to prevent manufacturers of manures asking whatever price they may think fit, but the question of judgment as to what is the real value is made simple by the establishment of unit values, which fix the prices for 1 per cent. of the three principal plant foods for the ensuing twelve months.

Notwithstanding the frequency with which departmental officers lecture on the valuation of manures, there still exists, I regret to say, only a hazy notion in the minds of many purchasers of manures how to apply the simple rules laid down for the calculation of the commercial values of these substances. It is only necessary to refer to the list of artificial manures sold in Victoria to find that between the price per ton asked, and the "real value" per ton, there is often a wide margin. I take it that every person, whether buying manures or any other article, wishes to get as good value for his money as possible, and yet we are confronted with the fact that very many farmers spend in the aggregate enormous sums of money every year in the purchase of substances that they practically know nothing whatever about. I do not suggest for one moment that fraud of any kind is attempted, but it must be admitted by every unprejudiced mind, that while such a state of things prevails, many purchasers of manures are not protected as they should be by their own knowledge and judgment. What remedy is to be suggested to protect the purchaser? The only effective remedy will be to make every farmer conversant with the provisions of the Manures Act, and to explain by means of a series of vigorous lectures in country districts the simple method by which every purchaser can ascertain the real money value of manures before ordering them. How often do we hear the statement made that such and such a manure was no good, and that it would not be used again. The ordinary rules of common sense tell us that it would be better to know beforehand than after the manure is put in the ground if it is worth the money paid for it or not.

In conclusion, gentlemen, I may be permitted to say that the best protection a farmer has is his own knowledge, and while it is too much to expect farmers of mature years to take up the study of agricultural science, there should be a better appreciation of the advantages to be gained by listening to these matters discussed on the lecture platform. The Department of Agriculture is not only willing but anxious to help those who wish to help themselves, and this can be brought about in no better way than by means of personal contact with those officers who have made these matters their especial study.

IV.—BEES.

R. Beuhne, President Victorian Apiarists' Association.

Being aware that probably few of you are beekeepers, as the term is now generally understood, I shall deal with my subject more in a general, and, I trust, useful, way than if I were addressing specialist beekeepers.

Bees are wonderful insects, as everybody admits. The researches of scientists and the observations of expert apiarists, whose daily work is amongst bees, have, however, cleared up much that was mysterious about

the beehive. The queen, usually supposed to be an autocrat, is in reality the mother, and the hardest worked inmate of the hive, her work being that of laying the eggs which produce the future generations of the colony. When at her best, a queen will lay up to 2,000 eggs a day. Should the queen, on account of old age or from some other cause, fail to produce the number required to maintain the strength of the hive, the workers will proceed to raise a young queen, who in turn will kill her mother, and then the remains of her late majesty are thrown outside without ceremony. This apparent callousness is but one of nature's provisions for preventing the extinction of the species. If the queen were left to die of old age this might occur during winter, a time when a new mother of the colony could not be raised, and as the queen is the only female capable of reproducing the species, the colony would become extinct.

The average life of a queen is two years, and that of worker bees only thirty-five days. Therefore, if the rate of reproduction is not equal to the death-rate, the chance of a surplus of honey, upon which the apiarist depends for his living, disappears entirely. When birth-rate and death-rate are equal, then the colony will continue to exist; that, however, is insufficient, for bees are not kept for amusement like canaries, but for profit. This is obtainable only when the rate of reproduction during the time preceding the honey flow is greatly in excess of the death-rate, so that a vast surplus over and above what is required by the bees themselves may be gathered while there are blossoms from which to collect it.

The ability of the apiarist to practise selection in breeding, and to replace queens as soon as they are past their prime, constitutes the chief advantage of modern bee culture over the former leave-alone method of keeping bees in common boxes. The substitution of a painted and ornamental modern hive for the ordinary gin, kerosene, or soap box is of little advantage unless the best methods of management are practised as well.

Many of you will doubtless know that years ago bees were much more plentiful and much more profitable when kept in box hives than they are to-day. The reasons are that diseases did not visit them, and that the natural flora from which bees gather nectar was much more plentiful than it is now. When the disease known as foul-brood made its appearance, bee-keepers, such as they were then, and bee-hunters unconsciously greatly assisted the spread of disease by carelessly leaving exposed, or purposely exposing, combs unfit to put into the straining-bag, the idea being to let the bees collect, and thus save the honey contained in such combs. When disease germs were present in the honey, infection was not only at once re-introduced into the colony just robbed, but was also spread to all hives far and near, which gathered the honey from these combs. In their own interest, as well as that of others, I would advise all who still keep box hives, never to let bees have access to any honey, honeycomb, wax, or refuse. Quite apart from the spreading of disease, the getting of honey by bees in this unusual and unnatural way, causes robbing habits and viciousness.

Of the many things with which bees are credited, one is that they know their master. This has no foundation in fact, for the man who can handle his bees without being stung can also handle bees other than his own in just the same way. It is often asked, how is it that bees will sting one person and not another? In answer, I may state that, in this respect, as well as in many other things, bees are guided by odour. Every person or animal has his individual odour. The dog tracking his master by scent

is a good proof of it. The odour of some persons, animals, or things is more objectionable to bees than that of others, hence the difference of bees in their attitude towards them. Amongst the odours that are very objectionable to bees are those of kerosene, camphor, eucalyptus oil, toilet perfumes, ants, raw meat, and similar materials. None of these should be handled by any one working amonst bees. Washing your hands ever so much will not entirely remove the odour for at least some hours.

Bees, when filled with honey, are much less inclined to sting than when empty. This explains the reason of the use of smoke, which causes them to fill themselves with honey, and thus makes them more harmless. A swarm which has just come out of the hive is rarely inclined to sting, whereas one which has been out many hours, or comes from an empty hive, is usually wicked.

It is impossible to deal with many things that I should have liked to within the space of a short paper, but I hope that, if it does nothing more, it will, on occasions, save you some painful sensations.

The Convention Papers will be continued in the September number of the Journal.

A GOOD COW.

That there are good cows in Victoria is evidenced from time to time, and occasionally very high returns are secured. A few days ago it was reported that Mr. Hall, manager of Mr. Cumming's property at Yarragon, had a particularly good cow. Mr. Herkes, of the Agricultural Department, was instructed to officially check her record, and he reports that she is a three-quarter Jersey breed, nine years old, named "Doris." She is by a Jersey bull, and her dam was from an Ayrshire cow by a Jersey bull.

This cow has had seven calves, and has been milking continuously for the last four years, milking each season on to the point of calving. It may be mentioned that after her first calf she milked for fourteen months, and was not a great producer till the fourth calving. She calved on the 15th March last, and was reported as capable of making 28 lbs. of butter per week. Mr. Herkes found her yield to weigh 29 lbs. and 28 lbs. for evening and morning respectively, with the same test of 4.5 for each, making the butter return for the day come up to 2.77 lbs. of butter, or at the rate of nearly 19½ lbs. for the week. When it is considered that the cow, when tested, had calved 3½ months previously, and that the test was made at the worst time of the year—in the depth of winter—the result must be regarded as highly creditable. A photograph of the cow is reproduced on the front cover of this journal.

R. C.

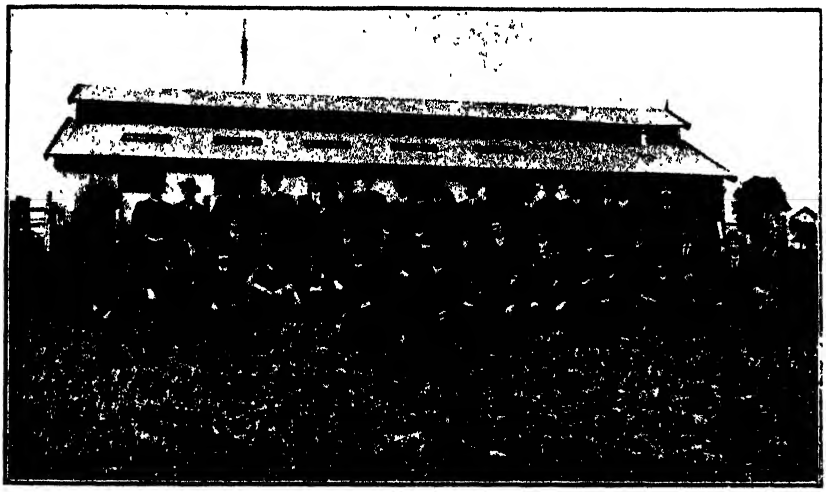
SCIENTIFIC INSTRUCTION IN DAIRYING.

R. Crowe, Superintendent of Exports.

In 1888, when the earliest butter factories commenced operations, the methods and applications used for butter-making were crude as compared with those of the present day. At the Centennial International Exhibition the late Mr. David Wilson gave instruction in Modern Dairying, and in the use of modern appliances, chief amongst which were the cream separator, power churn, and butter-worker.

There were no pasteurizers, coolers, refrigerators, Babcock testers, acidity or curd tests, &c., in those days, and the butter factory managers had little or no knowledge of dairy chemistry or bacteriology; they had to be full of resource and watchfulness in order to prevent wastes and make a good article.

A travelling dairy was sent round the country by the Government, and cheese instructors were also engaged. Then later on Mr. Potts held classes in various centres, and Dr. Cherry gave instruction in dairy bacteriology, &c., at the University.



STUDENTS VISITING WILLSMERE PARK DAIRY.

The Butter Factory Managers' Association was formed in 1894, and this mutual improvement association provided the means for butter factory managers to keep themselves abreast of the times. This year's conference was coupled with a course of instruction given by the Department of Agriculture at the University. Forty-two managers attended the course, which was of a scientific and practical nature, extending over a fortnight. Instruction in dairy bacteriology was given daily by Dr. Bull, and each afternoon practical instruction in milk, cream, and butter testing by departmental officers. Visits to dairies, freezing works, abattoirs, and ocean steamers were carried out, when demonstrations on cleanliness, refrigeration, and ailments of dairy stock were afforded the students. Six evening lectures were also given at the University. Afterwards the course was continued at the Cobden Butter Factory, where a fortnight's instruction was given in practical butter factory management. By no means the least interesting and valuable part of the proceedings was secured in visiting the Tandarook and Cobrico Cheese Factories, and the Camperdown, Grasmere, Colac, and Cororooke Butter Factories. Messrs. Archer and Herkes were in charge of the class during the whole of the country session.

The whole course was much appreciated by those who took part, and it goes without saying that, as the result, each and every one of them will show the benefit in their future practice.

STATISTICS.

Rainfall in Victoria.

SECOND QUARTER, 1906.

TABLE showing average amount of rainfall in each of the 26 Basins or Regions constituting the State of Victoria for each month and the quarter, with corresponding monthly and quarterly averages for each Basin deduced from all available records to date.

Basin.	April.		May.		June.			
	Amount, 1906.	Average.	Amount, 1906.	Average.	Amount, 1906. *	Average.	Total for Second Quarter, 1906. *	Average for Second Quarter.
Glenelg and Wannon Rivers	1.16	2.33	4.05	2.56	4.42	3.64	9.63	8.53
Fitzroy, Eumerella, and Merri Rivers	1.81	2.52	3.38	3.13	4.72	3.86	9.91	9.51
Hopkins River and Mount Emu Creek	1.19	2.37	3.38	2.45	3.88	3.23	8.45	8.05
Mount Elephant and Lake Corangamite	1.20	2.19	3.60	2.33	3.16	2.95	7.96	7.47
Otway Forest	2.85	3.64	4.51	4.51	4.25	5.09	11.61	13.24
Moorabool and Barwon Rivers	0.88	2.35	3.03	2.55	3.10	2.85	7.01	7.75
Werribee and Saltwater Rivers	0.66	2.41	2.29	2.56	1.77	3.05	4.72	8.02
Yarra River and Dandenong Creek	1.67	3.15	3.72	3.33	4.12	3.67	9.51	10.15
Koo-wee-rup Swamp ...	1.99	3.41	3.57	3.73	4.04	3.81	9.60	10.95
South Gippsland	3.25	3.61	2.55	3.71	2.97	4.56	8.77	11.88
La Trobe and Thomson Rivers	2.20	3.24	3.11	3.49	1.92	3.69	7.23	10.42
Macallister and Avon Rivers	0.70	2.86	1.62	2.10	0.81	2.46	3.13	7.42
Mitchell River	0.95	3.34	0.92	3.14	0.47	2.61	2.34	9.09
Tambo and Nicholson Rivers	0.89	3.01	1.05	2.70	0.86	2.71	2.80	8.42
Snowy River	0.57	4.04	1.21	3.14	1.08	4.45	2.86	11.63
Murray River	0.52	1.80	3.42	1.95	3.20	3.20	7.14	6.95
Mitta Mitta and Kiewa Rivers	1.77	2.38	4.55	3.13	5.00	5.29	11.32	10.80
Ovens River	1.38	3.04	4.90	3.54	5.33	6.36	11.61	12.93
Goulburn River	0.63	2.05	4.05	2.41	3.97	4.00	8.65	8.46
Campaspe River	0.34	2.12	4.89	2.66	4.70	3.69	9.93	8.47
Loddon River	0.22	1.73	3.80	1.87	3.96	2.78	7.98	6.38
Avon and Richardson Rivers	0.24	1.53	4.32	1.53	2.57	2.30	7.13	5.36
Avoca River	0.14	1.69	3.98	1.67	3.02	2.74	7.14	6.10
Western Wimmera	0.53	1.86	3.05	1.88	2.76	2.82	6.34	6.56
Eastern Wimmera	0.37	2.06	4.49	2.14	4.55	3.34	9.41	7.54
Mallee Country	0.13	1.27	3.27	1.22	2.15	2.37	5.55	4.86
The whole State	0.84	2.26	3.38	2.35	3.18	3.39	7.40	8.00

* Figures in these columns are subject to alterations when the complete number of returns for June has been received.

P. BARACCHI,
Government Astronomer.

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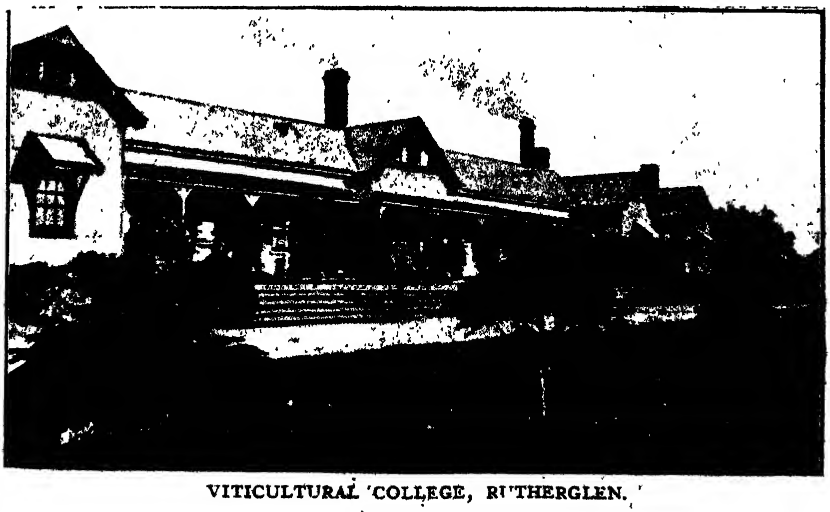
AMERICAN RESISTANT VINES.

Part III.

G. H. Adcock, F.L.S., Principal, Viticultural College, Rutherglen.

Hybrids.

A study of the American resistant vines without references to, and descriptions of, the hybrids, would be manifestly incomplete, since to these we are indebted for some of our most valuable stocks. These hybrids



VITICULTURAL COLLEGE, RUTHERGLEN.

may be the result of hybridization between various species of the indigenous American vines, or one parent may be of European and the other of American origin. The former are designated Americo x American, and the latter are known as Franco x American, and include what are called

direct producers. These have not been regarded with much favour here, nor adopted in the Commonwealth, owing to the somewhat limited resistance of the roots to phylloxera, and also to the peculiarities of flavour in the fruit.

One has only to look round a well-equipped garden to realize how much we are indebted to hybridization and selection for many of our choicest flowers, fruits, and vegetables. Much has been recently written in magazines and newspapers regarding the wonderful results obtained along these lines by Mr. Burbank, the "plant wizard" of America. Plant breeding is now an established industry in some parts, and just as animals are mated to secure desired characteristics in the progeny, so hybridizing is practised with plants to secure a desired end.

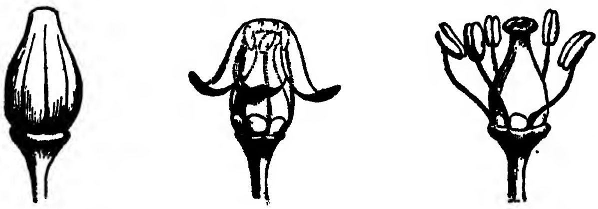
Every gardener knows that the setting of seed depends on the union of the two essential elements of flowers, sometimes called "male and

GRAFTED VINE, THREE YEARS FROM BENCH.

female." The golden dust known as pollen must come into contact with the adhesive surface of the stigma. In nature this union is brought about by the agency of the wind or by the visits of insects. Having reached the mature stigma, the pollen grain sends down a tube, which reaches down to the ovary of the flower. In this casket (ovary) are carefully protected the treasures of the plant (ovules), which are destined by means of fertilization to become seeds, and be the means of perpetuating the species. When the pollen tube has reached one of these tiny ovules, a minute body, known as a generative cell, passes down the tube. It comes in contact with specialized cells in the ovule or immature seed. Fertilization or fecundation takes place. The ovule is now transformed into a seed, and after having been allowed to ripen on the plant, will grow under suitable conditions, and produce a plant more or less like that on which it was formed.

A knowledge of the facts thus briefly outlined led up to the plant-breeding experiments now so widely conducted, and various hybrids pos-

sessing a combination of desired qualities have resulted. By utilizing as "parents" two plants possessing certain desirable and well-marked qualities, and "inoculating" the one from the other, we may obtain in the seedlings from the resulting seed, plants that possess one or a combination of the characters exhibited by the parents. Characteristics inherited from some more or less remote ancestor may also appear, and under certain conditions of environment even new characters may manifest themselves.



NORMAL VINE FLOWERS—DIFFERENT STAGES IN OPENING.
(From Manual of Modern Viticulture (Foex).

In connexion with hybridization among vines, as among other plants, great care is necessary to prevent other than the desired pollen coming into contact with the stigma. To insure this it is usual to remove the stamens from the parent plant on whose stigma it is desired to experiment, and also to take precautions to prevent foreign pollen being introduced by insect agency, or by means of the wind. Emasculation (as it is called) is a somewhat delicate operation in a flower so small and so peculiar in construction as that of the vine, whose petals remain joined at the apex instead of at the base, as in the case of most other plants. Special instruments are used,

SPRAY OF HYBRID 3306.

and having carefully removed the anthers (pollen cells) before any pollen has escaped, it is necessary to take ripe pollen from the other selected parent plant and place it on the stigma of the flower thus prepared as soon as it is ready to receive it. This may be done by shaking the ripe anthers over the stigmatic surface, or by transferring the pollen to its destination with a fine camel-hair brush. The stigma thus pollinated must be amply protected from adverse weather or insect-visits, for in the cold or wet weather the pollen may be either removed or injured, while if insects are allowed access, foreign pollen is sure to be brought, and so nullify the result.

Early in the economic history of the American resistant stocks it was seen desirable to overcome certain difficulties of adaptability, affinity, &c.,

of certain species. Imbued with the necessity and importance of this, a number of well-known viticulturists in France and elsewhere set to work to improve the varieties already known by hybridizing and subsequent selection.

Seeds from the hybridized flowers were sown, and in due time seedlings were obtained. These, while showing resemblances to one or both parents, also exhibit an immense amount of variation. A vigorous habit is a *sine quâ non,* and, consequently, all that do not possess this quality are eliminated. Resistance to phylloxera is the quality for which these vines are required, hence this has to be proved beyond doubt. When its vigour and

LEAVES OF HYBRID 101^{14}.

resistance are established, there are still other indispensable qualities before our vine can be recommended as a suitable stock. Its adaptability to conditions of soil and climate must be discovered, and the class of soil in which it succeds best must be noted. In some kind of soil every plant will do better than in others. One variety will succeed in certain soils where another would undoubtedly fail. In the case of certain American vines the resistance depends to a greater or less degree on whether they are planted in the conditions most suitable. There is still a further test that our vine must undergo, viz., that of ascertaining its grafting affinity. Certain scions will join well on one stock, indifferently on another, and even completely fail on a third, hence it is essential to find out the stock and scion best adapted for one another. Then, having found out the most vigorous and most

resistant stock, and having demonstrated the conditions of soil and climate, and what kinds of scion are most suitable, we have some data ready for our work of reconstitution.

Since 1899 the writer has, through evil report and good report, made a most careful study of resistant stocks under all the conditions of our varied viticultural areas, and if asked what varieties are the best all-round stocks for reconstitution, would unhesitatingly name some of the hybrids, particularly those raised by Couderc from hybridization of Riparia and Rupestris, and designated by the Nos. 3306 and 3309. Former articles descriptive of plants of both parent strains have shown their distinctive root systems. The hybrids combine in the one plant the root systems of both. This enables these plants to adapt themselves most readily to the conditions suitable to either parent stock. They are, in addition, vigorous in habit and excellent graft-bearers, while their resistance to phylloxera is the highest known. Hybrid No. 101^{14} of Millardet and de Grasset

SPRAY OF SOLONIS.

combines also the good qualities of the same parents. It is an exceptionally vigorous and useful stock, and is reported from California as doing well in limestone soils which American vines do not, as a rule, take kindly to.

Among Franco-American hybrids we usually gain in grafting affinity, owing to the European strain in the stock. Among the more meritorious of these are Aramon x Rupestris Ganzin and Mourvèdre x Rupestris No. 1202. The latter has the merit of adapting itself more readily to scions of the Muscat group than most of the American stocks.

Solonis, another stock of considerable merit, is regarded by Millardet as a ternary hybrid of Candicans x Riparia x Rupestris, while Mazade considers the European vine is also represented in the strain. Under ordinary conditions of soil it is greatly excelled by other stocks of a much higher resistance, but has the merit of being the only resistant stock adapted for alkaline or salty soils and wet situations, where its resistance—though not equal to that of the other hybrids already discussed—is yet quite sufficient for safety. In ill-drained soils it will thrive better than any other American stock, and it is not so susceptible to pourridie (root-rot) as most others.

A few other hybrids, including some of more than ordinary promise, are also cultivated, but those mentioned are the principal strains used.

The accompanying illustration represents the grafting shed recently erected by the Department of Agriculture at the Viticultural College to cope with the rapidly increasing demand for grafted vines. The building was designed by, and built under the supervision of, the writer. The dimensions are 60 x 30 feet, and the main building is surrounded by brick stratifying frames for stocks and scions. All round, at the height of the benches, are sashes 3 ft. 6 in. high, which provide ample light for the operators. Besides the men employed, twenty boys are being carefully trained in this important work. It is confidently anticipated that when a full supply of "wood" for stocks is secured, there will be no difficulty in meeting all demands for grafted vines, and that the reconstitution of vineyards in phylloxerated areas will be rapidly accomplished.

GRAFTING SHED, VITICULTURAL COLLEGE, RUTHERGLEN.

THE GOOSEBERRY.

James Lang, Harcourt.

This fruit succeeds best in the cooler districts of the State, but also does fairly well in many places north of the Dividing Range. It will grow in almost any kind of soil, but a deep sandy loam suits it best.

PREPARATION OF THE GROUND.

In preparing the land for a gooseberry plantation, see, above all things, that there is good drainage, either naturally, by an open porous sub-soil, or artificially, by means of underground drains not less than 2½ feet

deep and 40 feet apart. There is no plant more impatient of stagnant water at the roots than the gooseberry, and no plantation will be a success unless the land is well drained. Gooseberries do best in a plantation by themselves; many orchardists plant them amongst the fruit trees in the orchard, but this plan is not commendable, as they are in the way when working the orchard, and usually get torn out or broken down when ploughing and scarifying. In preparing the ground for planting, it should be deeply ploughed in the springtime, and allowed to lie fallow through the summer, scarifying it once or twice during the latter. In the autumn, about the month of March, the land should again be deeply ploughed, 8 inches at least, and then the harrow should be run over it to level it down. The ground will then be fit for planting.

PLANTING.

The plants should be planted in rows 6 feet apart, and 6 feet between the plants in the rows. This will permit of the ground being worked by the plough and horse hoe during the first few years of the plants' growth. Planted at 6 feet apart, it will take 1,201 plants to plant an acre. Do not plant too deeply, as the bushes, when planted, should have a clear stem above the ground of from 6 to 8 inches. If any suckers are attached to the roots, cut them clean out with a sharp knife, in order to prevent them from suckering again.

The after-cultivation of the plants will be the ploughing of the ground in the autumn with a small one-horse plough, when the furrows should be thrown up against the plants, leaving a furrow down the centre of the rows. Let it remain in this state during the winter; in the early spring the furrow should be turned the reverse way, and the strip of ground left in the rows should be levelled into the furrows with a strong hoe, which will leave the ground again level. Stir occasionally with the horse hoe to keep the weeds down and the soil loose.

PRUNING.

This is one of the most important points in connexion with the cultivation of the gooseberry. Most people imagine that the gooseberry will grow without any care whatever in the way of pruning, but this is a great mistake, as it requires the same careful treatment in pruning as does any fruit tree. It takes quite as long to prune a gooseberry bush properly as it does to prune an ordinary fruit tree. Most of the gooseberry bushes have a pendulous habit of growth, and it should be the aim of the pruner to combat this tendency by cutting the main branches always back to a bud with an upward tendency. In pruning the first season after planting, thin out the branches, leaving three or four to form the main branches of the bush; these should be shortened back to 3 or 4 inches from the stem. The following year all wood should again be cut away, with the exception of the continuation of the main branches; these should be shortened back at least one-half, cutting back to an upward bud. The third year another shoot on the main branches should be left to form a secondary branch, and should be shortened back the same as the main branches; also cut out all the spray shoots from the centre of the bush. The pruning for the fourth and subsequent years will be much the same; as the bush spreads out, more

shoots will have to be left to form branches. See that these are properly spaced at fairly equal distances one from the other, are not too crowded, and that no shoot is crossing another. All young growths from the centre of the bush will have to be kept clear.

If these instructions are followed out, the branches will be lined with fruit from the centre to the extremity, thus facilitating the gathering. Where time is available, an early summer pruning could be given by pinching back all young growths except those wanted to enlarge the bush. In pruning those varieties of gooseberries with a strong upward growth, always cut back to an outside bud; in other respects, the pruning will be the same as given above. The gooseberry bush is by no means the short-lived plant many people suppose; if it is properly looked after and cultivated it will live and be profitable for many years. The writer has in his orchard at the present time bushes over 30 years old, which are still bearing heavy crops of fruit of good quality.

PROPAGATION FROM CUTTINGS.

Gooseberries are usually propagated from cuttings. Take strong, young shoots, and cut them into lengths from a foot to 15 inches long. The base of the cutting should be cut clean across just under a bud; then cut out all the buds with the exception of four at the top, as this will prevent the plant from throwing up suckers afterwards. Plant the cuttings in rows 2 feet apart, and 6 inches between the cuttings. They should be put in slanting, leaving the portion with the four buds above the ground. The cuttings should be trodden firmly in, especially at the base. The next year these will be fit for transplanting. In planting out the young plants, any small roots that may have formed high up on the stem should be cleaned off, leaving a clear stem of 8 inches.

VARIETIES.

The varieties of gooseberries are very numerous, many hundreds being now catalogued. Most of the largest varieties originated in Lancashire, a county which is famed for the size and excellence of its gooseberries. Crown Bob (hairy red) and Roaring Lion are the varieties most favoured by market growers. Winham's Industry (hairy red) is a new variety, which is coming into favour, but, in the opinion of many growers, it is not so good as Crown Bob, which it somewhat resembles. Red Warrington (hairy red), a late variety, is undoubtedly the finest-favoured gooseberry grown, and stands the hot winds without injury; it is not a favourite with growers, on account of its strong, aggressive prickles, yet, notwithstanding this, it ought to be more grown than it is. Ostrich (smooth white), a large, broad-shouldered berry, is also a splendid variety to grow; it is a strong, upright grower, and bears heavy crops of berries of a large size. Whitesmith (long smooth white) is a good grower and prolific bearer. Lord Crewe (round, hairy white) is the earliest gooseberry to ripen. Billy Dean (long smooth red), which is very similar to Roaring Lion, is also good. The following are the largest gooseberries in cultivation:—Dan's Mistake, Red Robin, Clayton, London, red; Leveller, Leader, yellow; Antagonist, Postman, white; Stockwell, green.

THE WOOL INDUSTRY—SHEARING NOTES.

W. Haile, Instructor in Wool Sorting and Classing, Working Men's College, Melbourne.

As the season is now approaching when wool-growers will be making preparations for shearing, I therefore embrace the opportunity to offer a few practical suggestions how clips should be prepared for the market.

It is to be regretted that many sheep-owners do not pay sufficient attention to the "get-up" of their clips; they will pay high prices for rams to improve their flocks, but when shearing is in progress they allow their wool to be "got up" in a slipshod, instead of a scientific, manner. It should be more generally known that the manufacturers instruct their representatives here to purchase at a certain limit wool giving a good percentage of clean wool when scoured, that is, wool that will spin to a required number or quality of top. It therefore follows that if the wool be well and evenly "got up," the grower reaps the full advantage of the value of the clip. On the other hand, if fleeces of various lengths and qualities are pressed into the same bale, the valuing is made more difficult, and a good margin below the real value of some of the fleeces has to be allowed. Manufacturers know to a trifle what return a clip or portion of a clip will give them. One bale of the clip is tested—that is, it is given to a wool-sorter to divide the various qualities; these are weighed to a fraction, each quality is valued, and the result, profit or loss, ascertained. A sample of the clip is taken from another bale, and this, with the result of the trial bale, enables the manufacturer to instruct his representatives or brokers what to give for the same line next season. This accounts for many of our best "got up" clips finding their way to the same consumer annually. Personally, I have handled the same clips for years in England until a change in the breeding, or an alteration in the get-up, has caused certain clips to be boycotted. Therefore, if your wool-classer has placed your wool in the market and obtained a reputation, do not change.

In the get-up of lambs' wool, many sheep-owners do not pay sufficient care. They have valuable wool, which will amply repay them for careful handling and classification. I know several brands of Victorian lambs' wool so well classed that manufacturers use them without re-sorting; the qualities are even, there is no loss from inferior wool, and therefore they can afford to and they do give the highest market value for the same.

It is estimated that about one-third of the sheep in this State is owned by small holders—that is, farmers. This wool is nearly, if not all, sold in the local markets, and, consequently, has to compete with large clips. There are exceptions, and since the introduction of the Agricultural Classes for farmers and farmers' sons, several small well-got-up clips have commanded as much attention from the buyers as large clips. It therefore follows that if the owners of small clips desire to realize the prices paid for large well-got-up ones, they must raise the standard of their wools. To do this, defects in breeding, growth, and general character must be remedied, and more attention paid to the get-up of the wool. In placing any commodity on the market, the article should be made to look as attractive as possible. This principle applies to wool more than any article I know of, and there-

fore it is to the interest of every sheep-owner, no matter how small his clip may be, to carefully get up and place his wool on the market in the most attractive style.

The supervision of the clip must commence with the shearing. A fine day should be selected to commence shearing—a day that has been preceded by several fine days—as it is absolutely necessary that wool be dry when shorn. Any moisture or dampness is easily detected by an expert buyer; the wool has a clammy feel, and the longer it remains in the bale the worse the colour becomes, depreciating its commercial value. Whatever accommodation you have for shearing, see that the floor is perfectly clean; nothing spoils the appearance of wool so much as foreign matter, such as straw, chaff, &c. The floor should be thoroughly washed before shearing commences.

It is advisable, even for the farmer, to secure good practical shearers. He should see that each sheep is well and evenly shorn, commencing with the belly wool. The bellies should be detached from the fleece, picked up from the board and kept separately; in wether bellies, all stained pieces should be removed and placed in a bag or basket kept for that purpose. The shearer should open up his sheep in the ordinary manner, avoiding second cuts. If the wool is taken off evenly with the fleece its value is considerably enhanced; on the other hand, wool unevenly shorn is depreciated in value, as a uniform length of staple is much more appreciated by manufacturers.

As soon as a sheep is shorn the fleece should be picked up and thrown on the rollers' table. This table should be large enough to throw an open fleece upon it; many tables are made too small, and, consequently, portions of the fleece fall over the sides, with the result that skirters often tear off some of the most valuable wool of the fleece. The next process is skirting the fleece. In the case of a clean clip, one free from burr and seed, light skirting only is required. With ewes' fleeces the stained pieces should be removed before commencing to skirt a fleece; the stained pieces should be thrown into a basket or box conveniently placed near the end of the table, as this will save the piece-pickers unnecessary work in picking them out again. In skirting light, just take off the edges of the fleece, remove only the short, dirty and straggly wool, work around the shoulder, but do not cut it straight off, as this portion of the fleece is required to show the fleece off to the best advantage when rolled; remove the inferior portion of the breech, and also the shabby portions of the neck. If the back is weak, this should also be taken out and sold separately.

If the clip is seedy or burry, a much deeper skirting is necessary. It will be best to remove the burry portion from the clean wool; all the neck wool that is seedy or sticky should also be removed. See to it that not a staple more than is necessary is removed from the sides and shoulders of the fleece. The fleece is now ready for rolling. This should be done by throwing over the two breeches into the fleece, and turning over the neck as far as the shoulders; then turn in the sides, narrowing the fleece to about eighteen inches. Start rolling up firmly and evenly from the breech; the best portion of the fleece, the shoulders, is then exposed to view, thus giving the fleece its most attractive appearance. If convenient bins are handy, it is not necessary to tie the fleece. Above all things, avoid tying it with string, as many buyers will not look at a clip string-tied.

The skirts should be picked up from the floor—not swept up, as the usual custom is. In sweeping up, the pieces and locks get rolled up to-

gether; this gives considerably more work to the piece-pickers when separating the pieces according to their commercial value. In clean, lightly-skirted clips two sorts of pieces only will be necessary, *i.e.*, first and second pieces. The long, clean, lightly-seeded pieces should be called the first pieces, the short, shabby, yellow-yolky and very seedy pieces should go into the seconds, and the clean wool that generally constitutes the broken should be left on the fleece. If the owner insists upon deep skirting, three classes of pieces are necessary, viz., broken, first, and second pieces.

The bellies should have all stained pieces removed. When belly wool is of good length, and can be used for "combing" wool, careful skirting and trimming up would considerably enhance its value.

Whilst this portion of the work is being done under the classer or owner's supervision, the latter is busy classing or grading the fleeces. This should be done in a skilful manner, the object in view being the proper arranging of certain qualities or descriptions, in order to secure the best price for them. To do this efficiently he must study the requirements of the British, American, and Continental markets. As the yield of wool is the most important thing to consider in estimating the true value of the raw material, it will be readily understood how essential it is that the condition of wool in the various classes should be even throughout. Want of attention in this particular often prejudices the sale to a great extent.

In some clips, owing to bad seasons or other causes, a certain portion of the clip may be tender; the staple will be as long as the combing wool, but when tested for strength will break. Many owners place this with the short or real clothing wool. This should not be done, as all long-stapled, tender wool should be classed, and sold separately as "tender." All fleeces heavy in yolk and discoloured and rotted fleeces should not be classed with the leading lines, but kept out, and sold separately as "fleece."

The classing of crossbred in most cases shows a lack of knowledge as regards manufacturers' wants. These wools are placed on the market in a most irregular manner as regards quality and length, and in these cases would-be buyers either value according to the lowest-value fleeces or leave the lot severely alone.

These remarks apply not only to large clips, but to small, or farmers', clips. Users of wool are very particular regarding quality, and it would never do to mix several qualities together. Discrimination should also be made between high-class or well-bred wool and wool of a mongrel type. Manufacturers are asking that wool should be placed on the market in as even lines as possible, according to the size of the clip. The principal ground of complaint from wool-buyers has been the almost total neglect as to the condition of wool. Heavy, yolky fleeces, that will lose 60 per cent. in the washing, are baled up with lightly-conditioned fleeces that will give nearly that percentage of clean wool. The yield of wool is the most important thing to consider in estimating its true value. Want of attention in this particular often prejudices the sale.

To return to the classing of the fleeces; they should be divided into combing and clothing. Combing wool consists of all long-stapled strong wool. All you require to do to test a staple is to take, or rather draw (not pull out), a staple from the fleece. Take each end of it in the thumb and forefinger of each hand, stretch it out and test its strength, and, if strong, put that fleece in your "combing"; if long-stapled and weak, put it in your "tender"; if short, under one and a half inches, place it in your

"clothing." The combing sorts should be even and true to quality, the staple of each fleece being as near as possible of the same length, strength, and brightness. The number of qualities made depends on the clip itself. If the clip be exceptionally good, three combings, three clothings, and a dingy should be made.

In the combings the great bulk of the clip will constitute the first combing; this should contain the average quality and length of the clip. The super. combing will consist of fleeces a little shorter in staple, but much finer; the second combing contains all the fleeces stronger or coarser than the first combing, of deeper growth, but all sound wool.

In clothing the classes are made according to condition and quality. All short-stapled fleeces constitute the clothing. The super. consists of the highest quality, dense staple, and soft wool with fine serrations, for felting purposes. The first clothing will contain the bulk of this description; although not so fine as the super., it should still be bright, soft, and contain good carding properties. The second clothing is a wider sort, containing all the low-quality fleeces, and any short, rough, and shabby fleeces. These different descriptions should be branded in plain English, such as "Super., first or second."

I am speaking of merino wool now, and before leaving this type of wool I may mention that in some merino clips, where a portion of the clip is of very robust character, the bright, long, strong fleeces are profitably kept out of the second combing, and made into a line by themselves. All mushy, yellow, and inferior fleeces should be kept out, and branded "Dingy."

Lambs' wool should receive as much, or even more attention than the fleece. The lambs' fleeces when shorn should be picked up separately, and placed on the rollers' table. The rollers take the clean portion of the fleece from the skirting and belly wool, and pass the clean wool to the classer's table. If three classes are required, the classer generally prefers to make his own super. and first, at the same time rejecting any skirtings, low and shabby wool, and coarse breeches. The skirtings removed by the rollers are passed on to the piece-pickers, who secure any good wool left in, and also remove all stained pieces. These constitute the second lambs.

Crossbred and Comeback.—It is very difficult for buyers to value crossbred and comeback clips up to their intrinsic value, owing to the very irregular manner many clips are placed on the market. There are exceptions, but a large portion of our crossbred clips is placed on the market in a very irregular manner. You will find several grades in quality, long and medium stapled wool, all in the same bale. To value this a buyer must protect himself, and value low. If the clip will admit of good selling lines, classing should be done as near counts as possible, each class of an average quality and length of staple, all short, shabby, and matted fleeces to be kept separate and sold by themselves as "fleece." The highest grade will be a comeback, the next grade a super., the third grade a first X, the fourth a second X, understanding, of course, these lines will be reduced if the quality of wool is not there to make them.

Heavy fleeces, such as Lincoln or Leicester, should be kept separate, and branded accordingly. In lambs each cross should be kept separate if in sufficient quantity. Good length in lambs is a great factor in its value. In small, or farmers', clips, too much sub-dividing is not necessary, but make your lines as even as your clip will permit.

The pressing should be cleanly and carefully done, as an attractive appearance favorably impresses the buyer. One very objectionable practice

with pressers is not paying sufficient attention to the removal of bits of twine from the bale, and allowing them to fall on the floor. Hemp is very destructive to woollen machinery, and it also spoils any wool it gets mixed up with. Brand each bale as soon as pressed with the quality or description of wool contained therein, and sell at current market rates. If the full value is not bid for it, your broker will reserve it for future sale.

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(*Continued from page* 510.)

V.—HISTORY OF STOCK DISEASES IN AUSTRALIA.

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Australia offers a splendid field for the study of many biological problems, not the least important of which is the evolution of disease. Its isolated position and severance from other lands where various progressive and civilizing influences have been going on for ages, has left it far behind in the evolution of species in both the animal and vegetable kingdoms. The native fauna belong to all but extinct species, which renders them all the more interesting, and the platypus, or *ornithorhynchus paradoxus* of scientists, is said to provide a connecting link between the bird and the mammal. The aborigines are only on a level with the neolithic man of a bygone geologic period, whilst many plants are only represented by fossil forms found in other countries.

But little is known of the diseases that may have affected man or animals prior to its occupation by the white race, but it may be safely inferred that they were few and unimportant. With the exception of perhaps some of the common parasitic diseases they could have had but little influence on the imported species. On the other hand, the diseases introduced by the whites, such as measles and small-pox, have had a most disastrous effect on the aborigines, and it is quite probable that the extinction of some of the native animals may be hastened by diseases introduced by imported animals. It is also possible that some of the native species may act as retainers and transmitters of the germs of imported diseases. The domesticated animals introduced by the early settlers readily adapted themselves to their surroundings, and they and their progeny remained practically free from disease for many years; but as time went on one disease after another appeared among them until they can no longer be said to enjoy any special exemption.

Disease being the natural result of adequate causes, the importance of inquiring into their origin and distribution is self-evident. I therefore propose to give in this paper a list of the more important diseases with which the domestic animals in Australia have been assailed, but not having had access to the departmental records of the various States, I cannot be quite positive as to their exact order of sequence. I can, however, well

imagine that the parasitic diseases were first to make their appearance. Parasites are divided into two classes, viz., macroscopic, or those which can be seen by the naked eye, and microscopic, which can only be seen with the aid of a microscope; the former give rise to what are commonly called parasitic diseases, and the latter to so-called germ diseases.

Parasitic Diseases.

These may be caused by external parasites which attack the skin, or internal ones which invade the internal organs and tissues. As already stated, some of these may have been acquired from the native fauna, but the fact that nearly all are identical with those affecting animals in countries whence the original stock was obtained, points to the conclusion that in most instances they have been brought here in or upon their respective hosts. A familiar example of a parasitic disease of the skin is "Scab" in sheep, caused by the *acarus scabei*, and which proved so disastrous to flock owners in the early days. I have not been able to ascertain when it was introduced into the mother State, but have been informed by the Chief Inspector of Stock that it is believed to have been introduced into Victoria with the first shipment of sheep from Tasmania. Mange in horses, cattle, and dogs is due to parasites of the same species, which were probably introduced with their natural hosts.

The same may be said of ticks, lice, ring-worm, &c. The Queensland tick, which causes the fatal "Tick Fever," is said to have been introduced with the buffalo from India, and the fowl tick with fowls imported from the United States. The "Bot Fly" of the horse and sheep, and the "Blow Fly" of sheep appear to have been comparatively recent importations. Up till about fifteen years ago I had not seen a single "bot" in a horse's stomach, although I had made scores of *post-mortem* examinations for them, and now it is rare to find a horse without "bots."

The internal parasites are divided into three classes, viz., round, ribbon-shaped and flat worms, or, to use the scientific terms, nematodes, cestodes and trematodes. The round worms chiefly attack the intestines and lungs, and seem to have given trouble amongst sheep for a long time, more particularly in certain localities and during certain seasons. A dry season following a wet one, especially when feed is scarce, greatly favours a parasitic invasion. Young horses, cattle, pigs, and dogs have also their share of worm diseases, the mortality caused sometimes being very great. Tapeworms in some seasons have caused great mortality in lambs. Hydatids, which are the larval forms of tapeworms, are very common in the viscera of sheep, cattle, swine, horses, rabbits, and kangaroos, &c., but seldom cause any serious harm until they reach their ultimate host amongst the carnivora or omnivora. Flukes are common enough in both sheep and cattle, and while well known to be injurious to the former, seldom do much harm to the latter. The surface water holes, ponds, and swamps act as the chief propagating and distributing centres of the ova or larvæ of all forms of parasites, especially when the water gets low in dry seasons.

Infective or Germ Diseases.

The first serious outbreak of disease that I have seen any record of occurred in New South Wales in 1834. This is described as Malignant Catarrh, and there seems a strong probability that it was an infective and fatal form of pneumonia, due to some local cause. In 1847, Anthrax, or, as it was then called, "Cumberland Disease," made its appearance on the

Leppington Estate, near Campbelltown, New South Wales, and from there spread to the Murray and Lower Murrumbidgee, and on to the Darling Downs. In a letter written to the late Mr. Graham Mitchell, F.R.C.V.S., by the Chief Inspector of Stock, Queensland, dated 18th March, 1877, it is stated that a telegram had just been received saying that sheep were dying at the rate of twenty a night of Cumberland Disease, at Merino, on the New South Wales border. In 1876 the first extensive outbreak in Victoria occurred in the Western District, and hundreds of sheep were found dead in the camps. Since then millions of sheep have died of this disease, and many squatters, especially in New South Wales, have been ruined by their losses. Cattle, horses, and swine have also been victims, and not a few human beings, through skinning or handling the products of animals that have died of Anthrax.

How or when the disease was first introduced is not known, but, when investigating the cause of an outbreak in a dairy herd near Geelong some years ago, I expressed the opinion that it had been introduced by bone meal which had been given to the cattle to prevent "cripples." I took a sample of the meal to Dr. Cherry, who was then doing the bacteriological work at the University, and he confirmed the conjecture I had formed by making cultures of Anthrax bacilli from the meal. My colleague, Mr. S. S. Cameron, M.R.C.V.S., traced the bone meal to a shipment of bones that had arrived from India a little time before. Two other outbreaks occurred in the Dandenong district through using bone meal from the same source.

In 1858, Contagious Pleuro-pneumonia was imported into Victoria by a cow which was diseased when landed, and died within six weeks, having meanwhile infected the owner's herd. The disease was diagnosed by the late Mr. Henry Wragge, M.R.C.V.S., and had his advice—to immediately destroy the whole herd—been acted on without delay, Australia might yet have been free from it. Delay resulted in the disease being spread throughout the whole Commonwealth, and the losses have been enormous.

How or when Tuberculosis was introduced is unknown; probably some of the early importations of pedigree Shorthorns were responsible. This highly specialized breed has been exceedingly prone to the disease, on account of inbreeding and excessive pampering. Having experimentally produced the disease in an otherwise healthy animal by inoculating it with pleuro virus obtained from a beast affected with both Tuberculosis and Pleuro-pneumonia, I am convinced that the disease was largely spread by inoculating for the prevention of pleuro-pneumonia with tubercle-tainted virus. Shortly after my arrival here in 1880 I discovered that 25 per cent. of the cattle slaughtered at the Sandridge Bend Abattoirs were affected with tuberculosis, that there was no inspection, and that all the diseased meat was being sold for human consumption. I reported the state of affairs to the Chief Inspector of Stock, and called the attention of the public press to the matter, the result being the appointment of a Royal Commission in 1884 to inquire into the matter. Since then inspection has been adopted, and the disease has been greatly reduced.

In 1872 an outbreak of Foot and Mouth Disease was reported by the late Mr. Graham Mitchell as having appeared in a herd of cattle at the Werribee. The herd was destroyed, and the disease prevented from spreading. Another Royal Commission was appointed to inquire into the origin of the outbreak, and it was alleged to have been introduced by an imported Shorthorn bull.

Twenty-five years ago I read a paper on "The Prevailing Diseases of Stock" before the National Agricultural Society, and exhibited specimens of Actinomycosis or "Lumpy Jaw," and explained the nature of the organisms causing it. How long the disease had existed prior to that I do not know, but there is a strong probability that it is indigenous. When inspecting the dairy herds of the suppliers to the Bacchus Marsh Concentrated Milk Company some years ago, I found a number of cattle with swellings on the sides of the jaws, which, on examination, proved to be caused by accumulations of barley grass seeds. Some of these I was able to remove by hand. In many cases the lining of the mouth was deeply ulcerated, and in others there were distinct actinomycotic growths, showing that the fungus had found a suitable place in which to grow, and had been probably carried there by the seeds of the barley grass. The disease is not readily communicable from animal to animal, and being amenable to treatment, I am opposed to the wholesale slaughter of affected animals.

About twenty years ago Epizoötic Cellulitis, a form of influenza sometimes called "pinkeye," was introduced by an imported stallion and spread throughout the district where he travelled. Fortunately, means were adopted by which it was suppressed. Strangles has existed for many years, and it is probable that the organism causing it was here prior to the introduction of horses.

Swine Fever, pneumo-enteritis in calves, septicœmia hæmorrhagica in sheep and cattle, and fowl cholera are all due to organisms belonging to the same group. How or when they were introduced would be hard to determine. I am of the opinion that swine fever has existed in the Orbost and other districts for over twenty years, and that the theory that the germs of the disease were introduced with the seed maize imported from America is a feasible one. Only a few weeks ago it was announced in the daily press that an outbreak of swine fever in England had been definitely traced to the grain upon which the pigs were being fed having been imported from a fever-infected district on the Continent.

Since the dairying industry began to develop, numerous specific diseases that were seldom heard of before have made their appearance, and are exacting a heavy toll on the dairymen. Black Leg, or Symptomatic Anthrax, in calves has proved a great scourge, and some idea of its prevalence may be gathered when I state from my own knowledge that over 4,000 calves have been vaccinated with Pasteur's black leg vaccine during the past twelve months, and that other vaccines are being used as well. Other infective diseases, such as Contagious Abortion, Mammitis, Epizoötic Ophthalmia, and "Red Water," are also common in cattle, while infective Pneumonia, Petechial Fever, Influenza, Malignant Œdema and Tetanus in horses; Caseous Adenitis, Foot Rot and Cutaneous Abscesses in sheep; Distemper in dogs, and Diphtheria in calves and swine are seldom absent.

Some of the germs producing these diseases may be capable of fulfilling their life history outside the animal body. Others may pass through the bodies of native or imported animals without injuring them in order to complete the cycle of their existence, until some untoward circumstance gives them an opportunity for producing their deadly effects. In whatever way they conduct themselves certain it is that deadly diseases are continually making their appearance, and the best efforts of the bacteriologist, pathologist, and practitioner are needed to keep pace with them.

NON-INFECTIVE DISEASES.

There are certain non-infective diseases, chiefly of dietetic origin, which simultaneously affect a large number of animals, and this group is of equal importance to the one I have just dealt with, for the reason that they are continually present in some locality or another. and in the aggregate cause probably quite as great loss. It is a well-known fact that when food is scarce or unsuitable, and water bad, stock of all kinds become predisposed to disease. The disastrous effects of long seasons of drought and starvation being to a great extent unavoidable, need not enter into our calculation here. Stopping short of actual starvation, animals when reduced in condition lose their natural resistance to disease, and readily become the victims of parasitic and microbic invasion, and in this circumstance we have the primary cause of many outbreaks of disease.

The immunity from disease in the early days was no doubt due in a great measure to none but healthy stock having been imported and to the constant supply of suitable food and good water. Overstocking, droughts, taking up unsuitable country, careless breeding, and more extensive and perhaps less judicious importation, without inspection or quarantine, soon began to make their impression, and as time went on diseases increased in number and frequency. A further encouragement has been given to disease by the sub-division of the larger grazing areas, and so restricting the choice of food and water, and by the more highly specialized requirements of dairying and agriculture.

I shall not attempt to enumerate or describe more than a few of the more important dietetic diseases. The two principal diseases that were causing the greatest losses amongst horses 25 years ago were the so-called "Nasal Disease" and Stringhalt. The former has all but disappeared, but the latter is still with us, and is affecting quite a number of horses about Yarragon at the present time.

Nasal Disease, or, more correctly speaking, Osteo-malacia, chiefly affected young racing stock when put into training, and its appearance and disappearance may be accounted for in this way: At the time of its greatest prevalence nearly all the hay supply of Melbourne was grown within a few miles of the city, on land which had been cropped continuously for about 40 years without manuring, consequently it was deficient in the necessary nutritive qualities required by the young growing colts when in active training. When hay growing became general further afield, owing to better railway communication, the quality was better, and the disease gradually disappeared. In the Mallee and other wheat-growing districts, when the mares with foals at foot are turned into the paddocks to feed on the young wheat, the foals soon become ricketty on account of the wheat at that stage of growth being deficient in bone-forming material.

Whether Stringhalt can be regarded as a purely dietetic disease is still a doubtful point. The history of each outbreak, as well as of individual cases, and the symptoms which indicate embolism or plugging of the vessels of the affected limbs and of the pulmonary vessels, in some cases point generally to a microbic or parasitic origin, but further investigation and experiment is needed to elucidate its nature and origin, for which the private practitioner has neither the time nor means at his disposal. It may be worth mentioning that the first extensive outbreak with which I had to deal occurred over twenty years ago, at the late Mr. John Cobain's, on the Maffra road. One thing I have noticed in connexion with several out-

breaks, and which may afford a clue to work upon in any future investigation that may be taken up, is the fact that they were preceded or accompanied by a plague of caterpillars. When I drove from Sale to Mr. Cobain's on the occasion to which I have referred, the footprints of the horses and tracks of the buggy wheels were left on the road by the crushed caterpillars.

Some years ago I was assisted by Mr. Cameron in conducting a series of experiments to try and ascertain the cause of nearly all the horses going blind on several runs in New South Wales. We made several *post-mortem* examinations of the affected horses, and conducted feeding experiments on healthy ones. Though not absolutely conclusive, the results pointed to the blindness having been caused through the horses having eaten the wild tobacco plant, which the late Baron Von Mueller identified as the "*Nicotiana Sauviolens*," that was found growing in abundance on all the stations where the disease existed.

Throughout the coastal districts of Victoria, South and Western Australia young cattle suffer from a form of "Ricketts," known as "Coast Disease." This is caused by feeding on the poor indigestible, innutritious grasses which grow in these districts. On changing to a good inland pasture they soon recover. In many dairying centres the milking cows suffer from "Cripples," due to poor feed and the heavy drain of milking. Others from similar causes become affected with paralysis and die. In some cases hundreds of cattle are lost from this cause. The bone-chewing habit is indicative of soil deficient in available phosphoric acid and lime, and often leads to fatal consequences.

Many deaths occur from eating dead rabbits, but the cause of death is not phosphorus or arsenical poisoning, as some imagine, but pyæmia, or septicæmia, through getting inoculated with the germ-tainted bones. Many cases of cryptogamic poisoning occur from taking in the spores of fungi with the food, whilst plant poisoning is by no means rare. Old dry kangaroo grass and other grasses cause impaction of the rumen with fatal consequences. Numbers of animals also die from mineral poisoning in the neighbourhood of smelting works through the herbage becoming tainted with condensed fumes from the furnaces.

Unclassified Diseases.

Another group of diseases embraces those whose origin and character have not yet been scientifically investigated, and which go under the general name of "Mysterious Diseases." They are so numerous and varied that I shall not attempt to catalogue them here. Perhaps it will be thought that my list is already long enough, but I must crave your indulgence a little longer in order to state that there is yet another group which, so far as the every-day work of veterinary surgeons is concerned, is of more importance than any of those already mentioned. I refer to those sporadic forms of disease and casualties which affect individual animals, and in the treatment of which veterinary surgeons are mostly occupied, and out of which their livelihood is obtained. That this is a large and increasing quantity may be gathered from the fact that 25 years ago there were only four qualified veterinary surgeons, including myself, to do the work throughout the whole metropolitan area, besides a considerable amount of up-country work. On looking over the veterinary list published last January, I find there are now 40 practising in Melbourne and suburbs, and

yet I have no hesitation in saying that not more than 50 per cent. of the cases that need veterinary attention throughout this area receive it.

In the discussion that followed the reading of my paper before the National Agricultural Society, a quarter of a century ago, one gentleman stated that there was no disease amongst stock worth mentioning, and that veterinary surgeons were only alarmists and could be very well done without. My reply was that, unless the ordinary laws of nature were reversed in this country, the number of diseases would go on increasing, and that a day would come when stock-owners would be glad to have the aid of the veterinary surgeon, and something, I thought, should be done to prevent the spread of diseases.

What I wish to more particularly emphasize is the fact that a large number of epizoötic and enzootic diseases, affecting all kinds of stock and causing serious losses to owners, receive little or no attention at the hands of the practising veterinary surgeons, most of whom are centred in the metropolis or large provincial towns and cities, and that they come more within the domain of preventive medicine and should be dealt with by the departmental veterinary officers.

It is gratifying to know that Mr. S. S. Cameron, than whom no better man could have been obtained for the position, has been appointed Chief Veterinary Officer to the Department of Agriculture, and that other appointments are to follow, and I venture to predict that the advantages of establishing a veterinary staff which have long been recognised in other countries, will soon be felt and duly appreciated here.

Fortunately, science has kept pace with a number of diseases. Scab in sheep was stamped out by practical methods long ago. Pleuro-pneumonia is kept under control by quarantining and preventive inoculation. Anthrax and Black Leg are now restricted by preventive vaccines, and if Professor Behring's "bovovaccine" proves to be as efficient as is claimed, we are within measurable distance of stamping out Tuberculosis. A fuller knowledge of the life history of both micro and macro parasites will place the diseases which they respectively give rise to more under control, whilst the unclassified diseases will no doubt be more effectively dealt with when their nature and causes have been properly investigated.

The necessity for an institute of Veterinary Research, such as suggested in a very able and comprehensive article of Dr. J. W. Barrett in the *Argus* of 19th June, is beyond question, and there is ample work for a number of highly-trained veterinarians as departmental inspectors and laboratory experts, as well as general practitioners. The establishment of a degree in agriculture in connexion with the University is a step in the right direction, and the fact that veterinary science will form an important subject in the curriculum of study for that degree will help those who will eventually take the lead in scientific agriculture to a better understanding of the laws which govern the origin and dissemination of animal diseases. Draining damp soils, manuring and cultivating the poorer soils, growing suitable crops to tide over seasons of scarcity, and providing a better water supply, will all tend to place the animals under more suitable conditions, while a knowledge of anatomy, physiology, and hygiene should lead to the selection of sounder stock and the maintenance of a higher standard of health.

From the remarks made by the Hon. the Premier in his Brighton speech it is evident that he fully realizes the importance of conserving the health

of our live stock which forms the largest and most valuable of our assets, and that the Government intends to establish a Veterinary College. When I undertook the establishment of the existing institution, the principal object I had in view was to prove the necessity of teaching veterinary science to young Australians, and, although it has taken much longer to accomplish than I anticipated, no one is more gratified than myself to find that the State is willing to undertake the work.

"Ignorance," says Lord Avebury, "costs more than education," and if there is any department of knowledge to which this is more applicable than another, it is that which deals with the nature, causes, and prevention of animal diseases. I might have produced an array of figures to support the facts I have embodied in this paper and shown that an insignificant fraction of the money lost through preventible diseases would have been sufficient to establish and maintain one of the finest veterinary colleges in the world, but I am quite sure that no further argument is needed to convince you of the wisdom of making a higher standard of veterinary education available than it is possible for any private institution to provide, and of establishing University degrees in Veterinary Medicine and Surgery.

Not only should the new institution be a school of veterinary science, but also of comparative pathology, for there are many pathological problems connected with human, as well as veterinary, medicine, that need elucidation. Vegetable pathology, too, dealing as it does with the diseases of plants upon which all animals, either directly or indirectly, subsist, is scarcely less important. Many animal diseases are known to be due to eating diseased plants, and, as our knowledge of etiology increases, no doubt the inter-relationship will be found to extend. Whatever form the proposed institution may take, there can be no question as to the great advantage of a number of specialists in various departments of science working together with the common object of ameliorating the condition of human and animal life, and we may rest assured that the Hon. the Minister of Agriculture, who is doing everything he can to help the great producing interest of this State, will give the matter his best attention.

If there are still some who think I am looking at the subject from a veterinary stand-point only, let me point out that, compared with the stock-owner's, the veterinary surgeon's pecuniary interest is not worth mentioning. No veterinary surgeon has ever made a fortune—very few a competence, and the great majority only a hard-earned living. What we do claim is, that from the circumstances in which we are placed and our daily contact with those who suffer the greatest losses, we are in a position to speak with some authority on a subject which is of vital importance to the future welfare of this great continent, and if our advocacy—for a better recognition of the aid we are capable of giving—has made us appear somewhat self-assertive, I hope you will believe me when I say that our motives have been honest, and that our statements and convictions have always been sincere and capable of verification.

In conclusion, I wish to express my appreciation of the consistent support the members of the Chamber of Agriculture, ever since its inception, has given to every movement for the advancement of veterinary science, and to thank you for the patient hearing you have given me. Let us each take to heart the advice of Milton, who says:

> "Accuse not Nature,
> She hath done her part, do thou but thine."

VI. SYSTEMATIC DAIRYING.

R. Crowe, Superintendent of Exports.

The direction in which the greatest scope exists for improvement in our dairying methods appears to me to lie at the very root of our practice. Content hitherto with mere rule-of-thumb routine, and relying mainly on vaguely general results for their guidance, dairymen must now be induced to realize that accurate records, without which definite comparisons are impossible, are absolutely essential to a proper systematization of their work, and the rapid and permanent progress of the industry.

One of my first papers on dairying enforced the utility of individual records, and, although this same information has been published from time to time in different forms, and referred to by me at length in a previous address at your first Convention, held at Shepparton, its importance compels me to briefly touch upon it again. You will remember the monthly charts I suggested, with spaces along the top for the names of cows, and down the left-hand margin for each day of the month, with extended lines providing a space for the entry of the morning and evening's milk in lbs. weight. As they are now issued by the Department of Agriculture at nominal cost—only 6d. per dozen—and as one lasts a month, the outlay being thus only 6d. per year, there can be no obstacle whatever in the way of their adoption.

Were this system carried out, the slightest variation in the yield of every member of the herd could be seen at a glance, and should the quantity diminish the cause and its remedy would naturally suggest themselves; if due to a spell of cold weather, the best means of supplying shelter or rugging would come in quick and natural sequence. Any straw stacks on the farm might be rendered accessible, strips of hedges or clumps of trees planted, or shelter-sheds provided. The constant repetition of the lesson by means of the chart with every cold snap will bring a dairyman to a sense of his duty towards his dairy stock. Again, should the trouble be change or drying-up of pastures, or lack of feed, the extent to which the pocket and stock are affected is emphatically demonstrated. As a matter of course, all defects of management, whatever their origin—the dogging and knocking about or ill-treatment of cows, irregular watering, driving long distances, or keeping the animals too long in the milking yards without food—would be continually under observation. On the other hand, all practices having a beneficial influence would be immediately reflected, the lessons, being as they are not only within the knowledge of the dairyman himself but also under the immediate cognizance of each milker, are so well illustrated and so widely diffused that progress is inevitable.

Although attention has been continually directed to it for the last ten years, it is surprising to find comparatively few dairymen adopting the system regularly. Certainly, it is growing, but there should hardly be an individual claiming to be a practical man who does not religiously follow this plan. From my own experience, I can say that everywhere it has been put in operation the dairymen have been astonished at the re-

sult. The following paragraph is taken from a letter received only last week:—

"Only about six times during the past two years has our weekly herd test fallen below 4.0, whereas it used to get down to 3.4. Even then there was no more milk—actually less. Not only so, but the cows we now have for sale are eagerly sought after by previous buyers in our own locality. This is a good testimony to a system of culling by butter production, and selling cows by what they have actually done. We also send out each year a few young bulls from picked cows. Although we have not got up to the yields on many of the rich dairy farms, we are far above the average, and intend to plug along steadily."

NEW ZEALAND EXPERIENCE.

That Victorian dairymen are not alone in neglecting this important phase of their calling will be seen by the last annual report of the National Dairy Association of the South Island of New Zealand for year ending 31st May, 1906, in which it is stated—"Without doubt our dairy herds continue to deteriorate, and our exports of dairy produce, instead of showing by this time a substantial increase, show a slight decrease, for, even taking into account the fact that the cheese export this year shows a substantial increase, it is not sufficient to balance the shortage in the butter export. . . . . Our total export of dairy produce this year shows a decrease on that of the previous year. The increase each year since 1903 has been but small in proportion to the increased quantity of land and cows used in the dairy industry. We have been paying great attention to the manufacture and marketing of our dairy produce, also to securing reductions in freight, and many other most necessary and useful matters have been carefully attended to; but for years we have neglected the proper breeding and rearing of our young stock, and our herds have deteriorated steadily. Had we for years past attended to these matters properly, our export of dairy produce would have been 30 per cent. greater than it now is. It is quite true that a few dairy farmers have given these matters attention, and many of them have shown the excellent results obtained, and have made them known through the press and at conferences, but such dairymen are in a great minority. . . . . Land values have boomed in many parts, and such land values cannot be maintained with deteriorating dairy herds. A Dane gets as much out of one cow as a New Zealander gets out of two—all the result of breeding and weeding out and proper feeding. . . . . Positively we cannot go on as we are doing. Improvement in our dairy cattle is now imperative. Neglect of this may mean ruin to dairymen and to the industry, in view of higher prices for land and possibly lower prices for our produce."

THE ADVANTAGE OF KEEPING ONLY GOOD COWS.

The statement that a good cow consumes more food than a poor one, although generally believed, has seldom been tested in a scientific manner. Under the heading "Dairy Economics," a few days ago, in the daily newspapers, appeared a paragraph on the advantage of keeping only good cows.

A 120 days' trial has been made by the Agricultural Department of Ontario, with the object of testing the cost of food of a good cow and

a poor cow, giving the profit over the cost of food in each case. The Agent-General has forwarded the particulars of the results, which show that the profits from a good cow are very much greater than the increased cost of food. The results are as follow:—

Breed.	Cost of Feed.	Profit over Cost of Feed.	£100 worth of Feed sufficient for—	Profit from £100 worth of Feed.
	£ s. d.	£ s. d.		£ s. d.
Best Jersey	6 13 3½	10 10 5	15	159 16 3
Poorest Jersey	6 5 11½	5 11 3	16	89 0 0
Difference	0 7 4	4 19 2		70 16 3
Best Holstein	7 12 4½	8 11 9	13	111 12 9
Poorest Holstein	7 4 6	3 15 1½	14 (nearly)	52 11 9
Difference	0 7 10½	4 16 7½		59 1 0
Best Shorthorn	5 19 0½	6 15 8	17	115 6 4
Poorest Shorthorn	5 15 4½	0 8 1½	17⅝	7 1 4
Difference	0 3 8	6 7 6½		108 5 0
Best Brown Swiss	6 19 6½	5 15 8½	14	81 0 6
Poorest Brown Swiss ...	6 14 2½	3 2 3½	14	43 12 8
Difference	0 5 4	2 13 5		37 7 10

It may be noted that, at the rate quoted, the average cost for feeding the cows for a year would be nearly £20 per head, and the average gross returns would come to £36 13s. 6d. per head on the same basis; but this is not a fair deduction to make. It is referred to in order to show the high standard and cost of feeding adopted in the experiment, and the very high prices realised for the milk. It is a pity that the yields were not supplied, and the basis one that could be properly understood. However, as it was made by the Agricultural Department of Ontario, its reliability is taken for granted, and the lesson I wish to bring out is the principal feature of the table. When milk is sold retail for city supply at upwards of 1s. per gallon, it can be understood that the yields are not abnormal. Many Victorian cows give as good results.

Fifteen cows, such as the best Jersey, could be kept for the same period and under similar conditions on £100 worth of feed, and would yield a profit of £159 16s. 3d., whilst 16 cows, such as the poorest Jersey, would bring in only £89 18s. profit from £100 worth of feed; 13 best Holsteins would bring in a profit of £111 12s. 9d., and 14 of the poorest would return but £52 11s. 9d. profit. Seventeen of the best Shorthorns would show a profit of £115 6s. 4d., and Shorthorns, such as the poorest, would make a profit of only £7 1s. 4d. Fourteen of the best Brown Swiss could be kept, and show a profit of £81 0s. 6d., against the same number similar to the poorest, which would bring in a profit of £43 12s. 8d. In the comparison a most striking lesson appears, viz.—the best Shorthorns were 17 times more profitable than the worst Shorthorns in the competition.

Suggestions.

Now, my reason for referring to this phase of the matter at such length is to indicate two directions in which the practice of recording yields should be encouraged. In the first place, a herd-book based on yields rather than, or at any rate as well as, on pedigree, should be used. In the second place, prizes should be offered for cows giving the largest yields under normal everyday conditions.

In the first instance, a general register should be opened by some recognised body in the State—either the Royal Agricultural Society or the Department of Agriculture—for, under present circumstances, breeders' clubs, or associations would not serve the purpose. All cows should be eligible for registration on proof being forthcoming that the animal was capable of making, say, not less than 14 lbs. of butter per week. The owner of the cow or cows should be obliged to make formal application for registration, and give full particulars as to breed, age, colour, brands, marks, &c. An official or recognised authority would then be instructed to check the performance of the cow for a specified time, and, if eligible for registration by making more than the specified limit of butter for the period, the details should be entered accordingly. In this way all the respective dairy breeds would be afforded an opportunity of proving their value for dairying purposes, whereas if the matter is left to breeders' associations or clubs some dairy sections of cattle are sure to be unrepresented. The collection and publication of such data would in itself furnish a very much needed class of technical instruction. and the healthy rivalry thus engendered would be a most valuable incentive to progress. In course of time the periods could be extended from weekly to monthly, and eventually to yearly, returns for the different breeds. In my opinion, nothing can be suggested so peculiarly calculated to overcome all deficiencies as a step of this kind.

The other method should be in the nature of group or breed competitions—that is, prizes should be offered for the best group of, say, five dairy cows in the following classes:—Pure-bred Ayrshires, Jerseys, Shorthorns, and cows of any breed, which could be tested on farms at any time during the four dairying months of the year, namely, September, October, November, and December. The competitors might be permitted to choose the months in which their cows may be tested. A small committee of control should be appointed to carry out the arrangements and determine the date on which the respective tests were to be made. For instance, supposing there were 48 entries in the whole State, 12 for each month, the committee could meet in Melbourne and fix the test dates. I believe that if representations were made to the Honorable the Minister of Agriculture he would find a means of carrying out the tests, as the accruing data would be invaluable for instructional purposes. An officer of the dairy staff of the Agricultural Department could conduct the test on the farm, under the supervision of the president or vice-president of the local Agricultural Society, and in the event of either of those officials being interested some independent and reputable local authority. The committee could send an officer at an hour's notice to a certain farm, who would strip the cows, and weigh, sample, and test the milk with the Babcock tester, a duplicate sample being sealed and forwarded to the administrative committee, who should have the right to demand additional tests in the event of any abnormal results being disclosed.

A first prize of £10 and gold medal, a second of £5 and silver medal, and a third of £3, or an outlay of £20 in prizes for each class, should be sufficient; and as there should not be more than five classes, made up of Ayrshires, Jerseys, Shorthorns, and dairy cows of any other breed, in addition to the champion cows, for which a special gold medal and championship certificate should be offered, £100 would defray the entire cost for prizes; and, as before mentioned, the data accruing from the tests would more than recoup the trouble and expense involved in carrying them out. In the meantime, before closing this section of my address, I would again emphasize the necessity for the general adoption of recording tests as the controlling factor of the dairy farmer's practice. The improvement of pastures, the cultivation of fodders, ensilage, rational feeding and treatment, the culling of the herd, the rearing of calves from the best milkers only, and scientific breeding upon sound lines, must necessarily follow.

Through the American Holstein-Freisan register can be traced the performances of this particular breed of cattle for twenty years. The American Jersey Cattle Club records render the same possible with that breed. In each case the breeds are developed to a marvellous point of perfection; yet what do we find in Scotland, the home of the Ayrshire, at the present day? The authorities having control of this famous and excellent breed specify that the milk vessel should be well tucked up, and the elevation or outline of the animal should show a perfectly straight line from the brisket to the back of the udder. To secure this requirement, breeders are resorting to artificial means, by habitually strapping boards under the cow to support the milk bag, as well as diminishing or discouraging the milking propensity. A size of teat is also still adhered to that is calculated to confine the milking to girls and boys with small hands only.

Why should a cow be discarded because she has a well-developed udder, with good-sized teats? And yet this is actually what is being done when utility is ignored, or at least relegated to a secondary position. However, it is not necessary to go all the way to Scotland for an example of breeders breaking away at a tangent. In Victoria many like instances may be quoted. One in particular comes to mind. Names need not be mentioned, as most of you will recognise the case. A noted breeder of Jerseys followed up type and pedigree closely for generations, and overlooked performances. He was regarded as one of our most successful breeders, but at a sale recently, where many pure descendants of his stock were offered, scarcely a bid was given. What do practical dairymen want with beautiful little cows, nicely shaped and coloured, regular pictures, if they will not give plenty of milk?

Are we to continue following rule of thumb, with occasional crazes or fads, or are we to get right down to bed-rock on sound lines that insure permanent and steady headway?

Pigs.

No systematic dairyman is without pigs; they are an essential element to success. The latest statistics regarding live stock in Victoria prove that the number of dairy cattle showed an increase last year of 17,607, whilst pigs have decreased by 12,396. This is somewhat alarming, as well as discreditable. Although all the other rural industries of the

State are progressing, we find one of the most valuable declining. What is the reason? It must be a want of recognition or due appreciation of the important part that swine should take with the other live stock of the farm. On studying the position in the older dairying countries of the world, we find that pig products form a large proportion of the dairy products exported. There would be some excuse for our present state of affairs if the same conditions prevailed now as fifteen or twenty years ago when we had no means of reaching an export market. In those days every few years farmers limited the supply by knocking the young litters on the head. Such a practice was highly contagious, and was resorted to every two or three years in order to maintain the price at a payable level. Now, however, the markets of the world are available for our pig products in the shape of pork and lard, or bacon and ham, &c.

Former Exports.

So far back as 1893, pork was shipped to Great Britain from Victoria, and since then small parcels have been from time to time exported. Attempts were also made with varying success to ship the cured product in the shape of ham and bacon, but there was a certain amount of risk on account of the goods getting mouldy, and turning green *en route*. Large quantities of salt pork are shipped from certain countries to the British market, but for our purpose no way promises to be so successful as the shipment of frozen pork, and then the pigs may either be sold for consumption in that form or successfully cured after reaching their destination. Some five years ago an experiment was conducted at the Government Cool Stores; the carcasses were placed in the cool store for from six to eight weeks, then were taken out, thawed, and most successfully cured. This led to considerable quantities of frozen pork being shipped to the South African market to be cured on arrival there. Again, in the drought period, large quantities of American frozen pork were landed at Sydney, Brisbane, and Melbourne, and cured for consumption here. In comparison with the importations from abroad, our pigs proved to be better than any secured from elsewhere. You will all remember the carcasses exhibited at the Royal Show some time ago when local pork was shown beside carcasses from America, Holland, and Ireland, the Victorian comparing most favorably with the others.

Advice from London.

In a recent report from Mr. Peppard, Inspector of Produce, London, through the Agent-General, the following appears:—

"The frozen pork shipped here from Victoria this season has given entire satisfaction. It met with an exceptionally good market owing to short Irish and continental supplies, and the prices realized must not be taken as representative of a normal season. The average price of frozen pork is from 4d. to 4½d. per lb.

The pork season here extends from September to April, for there is some legend to the effect that we should not buy pork unless there is an "r" in the month.

Pigs can be almost any weight, provided they are meaty, but very fat pigs are not wanted. Pigs weighing between 60 and 90 lbs. are worth about ½d. per lb. more than pigs over 90 lbs., because the latter are only useful for chopping purposes. It is not deemed necessary to

grade, and salesmen do not recommend marking the weights on the different carcasses, as owing to shrinkage on the voyage they would be inaccurate.

The carcasses should be well dressed, and stout wraps used to keep them clean.

The pleura must not be removed, because the meat inspectors have instructions by order of the Royal Commission to immediately condemn any pig from which the pleura has been removed.

Very strict inspection is made of pork on the London market, and carcasses where glands have been opened are not treated with any suspicion, as the authorities here consider it a *sine qua non* that they have been subjected to rigid inspection at time of slaughter.

Some carcasses arrive here without heads, but it is suggested to leave the heads on.

Fire brands should not be used. Ear marking is not objected to, although the label with leaden seal as is used with mutton is preferred.

There is no reason why we should not be able to develop a large and profitable business in the frozen pork trade, as the Berkshire breed, which is most common with us, seems to give the greatest satisfaction on the London market. All that is necessary, in addition to the foregoing, to attain this object is to have more regularity in arrivals."

The following advice on the subject is given by Mr. W. Lane Mitchell:—"The season here runs from September to April, and we cannot do with arrivals until late August.

The best weights here are from 60-90 lbs. Heavy weights run from 90-120 lbs., and bring quite ½d. per lb. less than light weights.

Keep heads and feet on, and leaf in.

Double wrapping is not necessary for this market, a good stout sheep shirt being sufficient.

If it is necessary to have any Government stamp put upon the pigs, please see that the stamp is placed either on the ear or on the skull.

Queensland pigs are much rougher in the skin, and much darker in colour than pigs shipped from Sydney and Melbourne.

The normal value of pigs, 4½d. c.i.f.

Buyers will not accept colonial weights, and there must be the same guarantee as with meat, namely, seller guarantees any loss in weight over 2 per cent. There is not any draft as with mutton or lambs, and only the actual tare of the wraps is allowed.

Quality to be 'good average.'

I think consignments give better results than selling c.i.f."

Victorian Pork.

The pork exported from Victoria last season realized up to 5⅝d. per lb., and the expenses, including killing, freezing, freight, and other charges, are fully covered by 1d., so that the grower was left 4⅝d. at this end. When prices are normal, as quoted by Mr. Peppard's report, there should be 3½d. per lb. left for the growers here, or 4d. for the more popular weights. Although 4½d. is reported as the normal price, the actual figures of the last two seasons show an upward tendency; for 1904, the average came out at 4.82d., and for 1905 4.9d. per lb., so that the grower here, if catering for the London market regularly, would have received almost 4d. per lb. for the pork, a much better price than

he could have obtained in Victoria. I know certain bacon factories that occasionally secure their supplies at 3d. per lb.

A photograph of some carcasses recently exported is reproduced on the cover of this number of the *Journal.*

BRITAIN'S IMPORTS.

The imports of pig products into Great Britain now average upwards of 21 million pounds sterling, whilst the butter imported to the same country is equal to 21½ million pounds sterling, so that from these figures the importance of pig products may be realized. The chief country supplying Great Britain's requirements is Denmark, with 5½ million pounds sterling, and the exports of butter from that little country come to nearly 11 million pounds sterling, so that the pig products are valued at almost half their marvellous butter export. If Victorian dairymen grew pigs in the same proportion to their operations as the Danes do, we should now have an annual export trade of over three-quarters of a million pounds sterling, instead of only £50,000. Dairymen of Victoria, do you realize that in neglecting pigs you are losing some £700,000 per year?

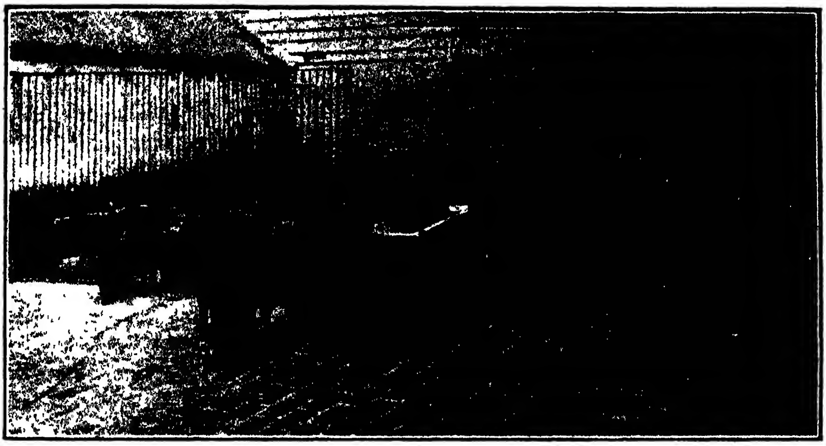
It is evident that there is a lack of interest in the subject, and more attention must be directed to the breeding, rearing, feeding, and management of pigs.

HISTORY OF THE PIG.

The original wild pigs were very different to the animal as we know him now, they had long noses for the purpose of turning up the ground in search of roots—their chief food supply—and tusks to defend themselves from their enemies. They had good lung capacity, and some were in shape not unlike greyhounds. The original old English pig was a slothful, coarse, hairy, repulsive looking animal, and it was not until early in the nineteenth century that any material improvement was effected, and now it is justly claimed that far greater improvement has been secured than in any other farm animal.

Lord Western, while travelling in Italy, came across some Neapolitan pigs, which were far superior to anything they had in England. He procured a pair of thoroughbred Neapolitans. This was the beginning of the systematic improvement in English-bred pigs. The cross-bred Neapolitan, Essex, Sussex, and Berkshires had great success at agricultural fairs, but as Lord Western practised in-breeding, his pigs gradually lost size, constitution, and stamina till at the time of his death, in 1844, the Western breed had so deteriorated as to become more ornamental than useful, while the whole district had benefited from the cross. The highly refined Neapolitan breed was of great value to cross with the large, vigorous, English sows, but was not profitable to raise purely for slaughter. Later importations from China were crossed with English pigs, with the result that an impetus was given to pig-raising, and scientific crossing became the order of the day. Nearly every county in England had its own breed of pigs, Cumberland, Yorkshire, Durham, Lancashire, Cheshire, Lincoln, Devonshire, Wiltshire, Norfolk, Sussex, Essex, Herefordshire, Hampshire, and Berkshire; and the merits of the best were eventually recognised. Now the Berkshire breed stands at the head of the list in popular favour throughout the world, the present improved Berkshire being the product of a cross between the Chinese and old English pig. Next come the Yorkshire and Tamworth. For

very many years in Victoria Berkshires have predominated, and as practically no importations have been made recently, the breed is deteriorating, hence better results are secured by crossing with the Tamworth or, better still, with the Yorkshire. In crossing, however, it should be always borne in mind that only pure bred boars should be employed. Some people regard the pig as a low animal, and look down upon him, but it may be pointed out that amongst the most successful exhibitors at the Smithfield shows was H.R.H. the late Prince Consort, who developed what has since been known as the Windsor breed, and who for nine years running figured as a prize winner at the Smithfield show. There was another fashionable breed known as the Prince Albert Sussex. These facts are mentioned with a view to popularizing pig-raising.



BERKSHIRE STORE PIGS.

The aim of breeders has been to obtain a pig that will produce the largest amount of pork for a given quantity of food. As compared with the stomach of cattle or sheep, that of the pig is only about one-fifth in proportion to its live weight. It is therefore evident that the pig requires more concentrated feed than a bullock or sheep, and is not so well adapted to thrive on grass, hay, &c. It might be reasoned from this that as a steer or a sheep can subsist and fatten on less concentrated and less costly food than the pig, that 100 lb. of beef can be produced at less cost than 100 lb. of pork. There are, however, several things to be considered in this connexion. Pigs eat food which can in no other way be utilized, such as the refuse from the house and dairy, small potatoes, unmarketable grain, and grain in the stubble. They are great eaters, and can devour, digest and assimilate more nutriment in a given time in proportion to their size than any other domestic animal. They should always be fed, and it should be recollected that an animal requires a certain amount of nutritive matter merely to sustain life, the actual quantity requisite varying greatly according to the conditions in which it is placed. When kept comfortably warm and quiet less is needed than if the pig is exposed to cold. Another economic aspect that should not be lost sight of by the raiser of pork is that the more compact the pig, the cheaper will it manufacture its food into pork.

Best Type of Pig.

You are all aware that a sphere possesses greater holding capacity in proportion to its exposed surface than a cube of like diameter, and a cube more than an oblong of similar surface. So it is with pigs. The compact pig presents less area for radiation than his longer brother of the same weight—in other words, less food is required to keep up animal heat. This contention does not, I know, coincide with the opinions of pig fanciers of the present day. They prefer a long beast; but a little reflection should convince them that the shorter pig ought to be the better, not only for the reasons already mentioned, but also because the ham—the more valuable part—then forms a greater proportion of the whole weight. The same result has been proved by experience in the case of lambs—a short, nuggety, compact, meaty carcass with short legs, light bone, and the more valuable portion, leg of lamb, forming a maximum percentage of the whole weight. Still another point in favour of the short pig is, that in proportion to its weight the bones are smaller. Any one can understand that a bridge with a long span requires to be much heavier to carry a given weight than one of shorter length. So much for breed and shape. Pigs should always be given as much food as they can eat, so that they may grow and be fattened off at the earliest possible moment. As with other animals, so with the pig, it takes a certain amount of food to keep up animal heat. and provide against wear and tear. Let it be assumed that for a given time 100 lbs. of food is necessary to maintain the animal; if an additional 25 lbs. is assimilated, the whole of this will be turned into pork; if it is capable of digesting a further 25 lbs., double the result will be procured on 150 lbs. weight of food than will be obtained from 125 lbs.

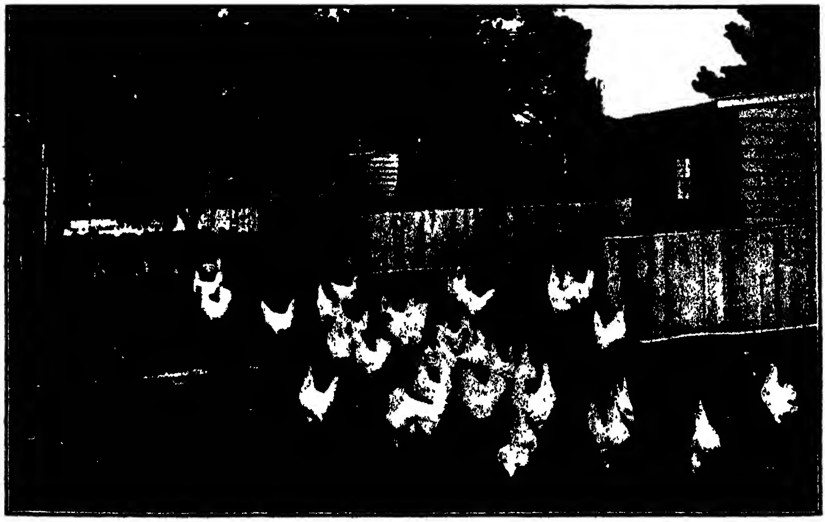
Modus Operandi.

As already mentioned, the markets of the world are open to growers and exporters. All that is necessary is to communicate with the Agricultural Department, when full particulars and assistance will be afforded. Arrangements can be entered into for slaughtering pigs at either the City Corporation Abattoirs; Mr. Wm. Anderson's, Ascot Vale; Mr. David Mitchell's, Lilydale; or other places. There is no reason why the slaughtering should not also be done in country districts later on, and the carcasses forwarded by rail in meat trucks to the Cool Stores, where handling, freezing, bagging, and shipping are done for a consolidated charge of 9d. per carcass, or 6d. per side, including twenty-one days' storage. Until business connexions are established, the Agent-General is available to hand over consignments to reputable firms for realization on owner's account to best advantage. This, however, is not advised, and shippers are encouraged to make their own business arrangements. Should they not care to do so, there are many agents in Melbourne eager to be negotiated with. Advances on the goods are as readily procurable as they are with butter, there being no difficulty whatever in getting the matter financed. At the present moment certain shipping firms and agents are prepared to advance 4d. per lb. on consignments. It is therefore to be hoped that breeders will grow at least two pigs in the future for every one they have reared in the past. There is ample room for it, and till something of this nature is done they cannot expect to be credited with making the best use of their opportunities.

VII.—POULTRY AS AN ADJUNCT TO THE FARM *

A. Hart, Poultry Expert.

The profitable returns attached to an intelligent system of poultry raising renders this subject one of interest to every farmer in the State. There exists an unlimited market for eggs and poultry in England, which is largely supplied by France, Russia, and America at present; but the fact that these countries can only supply England during the spring and summer months throws open this highly profitable market during the cold weather to the poultry farmers of Victoria. When we consider that England alone paid last year £8,000,000 for poultry and eggs to foreign countries, and that this demand steadily increases, there can be no doubt as to the profitable nature of the business.



PENS FOR EGG PRODUCTION.

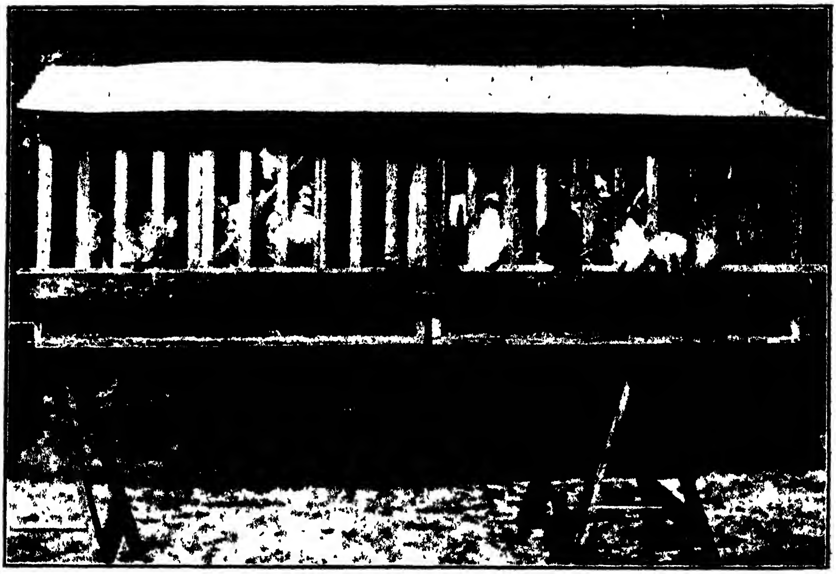
There can be no question about the value of the export trade in poultry under the supervision of the Department of Agriculture, as the shipments have been so satisfactory. It is a pleasure to note the steady improvement yearly taking place in the quality of the poultry sent to the depôt for export. This has already had the effect of attracting a good demand, and to-day you have the English buyers practically at your own doors, in Melbourne, giving 6d. per lb. live weight for all chickens, ducklings, and turkeys that Victoria can produce. After they have been passed by the Government grader at the Cool Stores, the vendor can receive his cheque straight away. Owing to the keen competition for chickens and ducklings for export, the ruling price in the Melbourne market has been from 1s. to 1s. 6d. per pair higher than last year. These facts are mentioned simply to show that there is ample scope for increased attention being given by those who are favorably situated to take part in this interesting and money-making phase of farm life, especially when, with

* Lantern Lecture.

our splendid soil, glorious climate, and cheap feed, our producers have natural advantages second to none in any part of the world. I would recommend every farmer to give his serious attention to this means of increasing his income. As in other pursuits, competition demands an up-to-date knowledge of the industry in all its parts.

Preparing Chickens for the Market and Export.

All chickens intended for the market should be placed in fattening coops to hold twelve birds. The cockerels must be kept separate from the pullets. The birds should weigh 3 lbs. each when placed in the coop at 12 to 14 weeks' old, and should be of the heavy breeds of fowls. For twenty-one days they should be fed three times daily on the following:—Wheat, heavy Algerian oats, and maize, which should be all crushed fine and mixed together, scalded with skim milk, and mixed



TWO FATTENING COOPS MADE OUT OF A PACKING CASE.

A false bottom, made with 1½-inch mesh wire, is provided. It is raised 3 inches above the floor, to enable the latter to be easily cleaned.

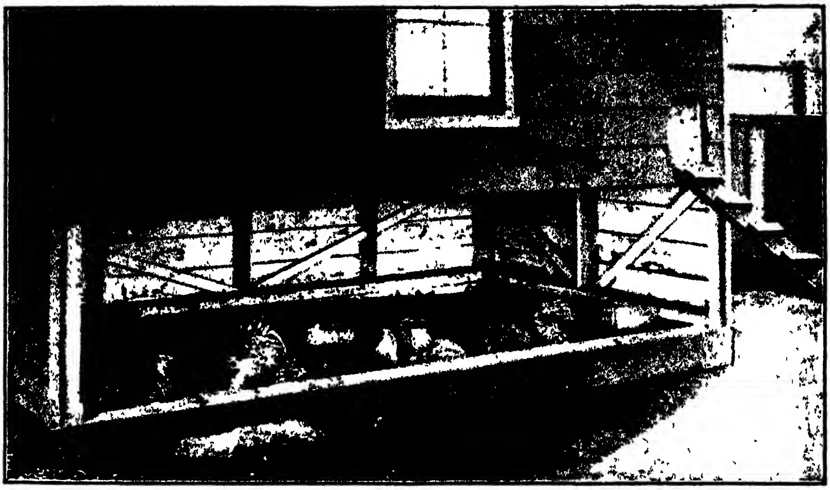
with kitchen scraps, or rendered fat. When fat is used, allow 1 lb. to twenty birds three times a week. All food should be given moist in a crumbly condition, and in cold weather should always be given warm. A liberal supply of grit, wood cinders, and green stuff should be allowed the birds daily. The grit is practically the fowl's teeth, and is required for masticating the food in the bird's gizzard.

To hold twelve birds a coop should measure 6 feet long, 18 inches wide, 20 inches high, and be made of wood, partitioned off in the middle, and all inclosed, with the exception of the front, which is latticed with laths 2½ inches apart to allow the birds to feed and water themselves from a V-shaped trough placed on the outside of the front of the coop. The doors should be made at the back for the purpose of cleaning the coop

and removing the birds. The roof should be made of palings and overhang to prevent the weather beating into the coops when they are in the open. All coops should face the east.

Egg Production.

A suitable house for egg production (to hold twenty-five birds) should be 6 feet long, 5 feet wide, and 7 feet high. The floor should be 2 feet from the ground, and the front of the house should be boarded 3 ft. 6 in. from the floor up, with 18 inches of wire netting at the top, and should face the east, with the roof overlapping the front by a foot, so as to prevent the rain beating into the house. The door should be at the back, and slide up for the purpose of cleaning out and letting the inside of the house get the benefit of the afternoon sun. Underneath the floor of the house the space can be used as a dust bath and shelter shed. The yard should be 100 feet x 25 feet.



DUST BATH AND SHELTER.

A dust bath is absolutely necessary in the poultry yard to insure success in keeping down vermin, increasing egg production, and checking disease. It consists of wood ashes, sand, and sulphur or tobacco dust.

An ideal yard for breeding pens or egg production, to hold twelve birds, should be 50 feet x 20 feet. To increase the egg supply, no male bird should be allowed with the hens. The eggs will keep from 7 to 10 days longer in cold weather, and the farmer can regulate his feeding, and see which are his best layers. It is impossible for the most skilful man to get good results from large flocks of birds running together.

An essential to success in poultry is the turning over the ground once or twice in the year. As you are well aware, this sweetens the ground, keeps the fowls healthy, and checks disease.

The fowls' droppings, coupled with the climatic conditions, make the growth so strong that one farmer has to keep twenty breeding ewes for the purpose of keeping down the grass, and they return him £20 per year for lambs and wool.

Selection of Hens.

Silver Wyandottes are noted for their table properties, but by careful selection and feeding their egg-producing properties have also been developed, and at the Dookie Agricultural College laying competition, just over, they secured premier position with a total of 1,296 eggs. The value of the eggs (six birds) is £4 15s. 7½d., or an average per hen of 15s. 11¼d. Put down the cost of keep at between 4s. and 5s., and you have the very handsome profit of close on 11s. per bird. This stamps the Wyandotte as an all-round utility bird. The eggs shown on the screen (1,296) represent the quantity laid by the six Wyandottes. They were all brown shelled, and their value in the English market is 1½d. to 2d. per dozen more than the white shelled.

White Wyandottes are also a table variety, yet secured second place in the Dookie competition—1,277 eggs, value £4 17s. 0¼d., averaging 16s. 2d. per bird, again showing the importance of breeding and selection.

White Leghorns secured third honours—1,250 eggs, value £4 17s. 4d., averaging 16s. 2½d. per bird. These birds scored owing to being non-setters and good workers, and laying when eggs were dear. These birds were of a good laying strain, and were egg producers, not like a great many of the Leghorns, which are drones on the farm, and do nothing else but make comb and flesh. This goes to show the importance of trap-nesting to build up a good laying strain.

The birds now illustrated are a cross from a Silver Wyandotte rooster and Buff Orpington hens, and they have scored in the export classes wherever shown. Their success has been due to a liberal supply from the cornsack, which goes to prove that more than half the breed goes down the throat. The cross is a good one, whether for producing white legs for table purposes or for egg production.

Feeding.

The best morning meal for egg production is two parts pollard, one part bran, one part lucerne chaff, which should be scalded with skim milk or boiling water, and mixed together, and given to the birds in a crumbly condition, and should be placed in a trough or feeding board, and not on the ground. For abundance of eggs, milk or boiled animal food mixed through the mash should be given three times a week when treating birds for egg production only. For the evening meal give grain, consisting of wheat, heavy Algerian oats, and maize, the last being used in winter months only, and then sparingly. The best grain is always the cheapest in the end.

Economy in Watering Poultry Yards.

As you can see on the screen, the tank consists of a 10-feet sheet of iron curved to a circle, and is erected on a staging about 6 feet high. A water service is laid from it by means of old gas-piping and cheap low-pressure taps all over the yards. By the use of the stopcock, you can regulate the supply as required. This greatly saves labour, and keeps the expenses down. The trough is constructed of a piece of spouting soldered at each end, and is about a foot long. This is covered by a kerosene case, with one side off, which faces the south, and serves to protect the water from the rays of the sun.

Chicken Housing and Feeding.

The model chicken coop is so constructed as to protect the chicks from the cold, bleak winds and the rays of the hot sun. It is par-

titioned with small mesh wire to prevent the hen and the sparrows from getting at and eating up any little delicacy that may be given to the chickens during the first month, which is the most critical time of their lives. It is always advisable to place a dry sack under the coop to protect the little ones from the damp grass, and it makes it easier for them to find their food.

A tray for successful chicken feeding is a simple contrivance, and as you can see, prevents the hens from gobbling up the food that you have specially prepared for the chickens. A plain tray, with sparrow proof wire netting on top, and raised from the ground on legs about 3 inches, is placed on a dry sack.

The other view shows you the chickens enjoying their meals whilst the hen is absent foraging on her own. The chickens' meal should consist of—for the first month—coarse oatmeal given dry, kitchen scraps,

BREEDING PENS.

The houses are made out of packing cases, 3 ft. 6 in. x 3 ft. 6 in. x 4 ft.

and bread crumbs, with rape or any greenstuff chopped fine every day. A regular supply of fresh water should be on hand, and the same kept out of the sun.

When soft food is given it should be scalded with milk, and you should add a little fresh-cut green bone twice a week. Before feeding on grain, which should be crushed, the chickens should be supplied with fine grit. Where special feeding is required groats and canary seed are very good for quick maturing young birds.

To encourage young chickens to exercise themselves, and work for their food, a barrow load of dry stable litter or pine needles is the best thing you can give them to scratch in.

Tree lucerne makes the best shelter for poultry yards, and owing to its rapid growth and its feeding properties for poultry and bees, it is absolutely the best hedge that can be planted. To keep the foliage close to the ground always prune from the top. Thousand headed kale is one of the best green foods for poultry; with the use of a little water, one stalk will renew its green leaves every month after stripping. The plant will last for three years.

A scratching heap, consisting of stable litter or pine needles, is essential to egg production by making the fowls work for their food. This should be made the feeding place for the grain meal.

Profit in Eggs.

All eggs should be gathered at a regular time, say twice a day. Trap-nests will enable the gatherer to know the egg of every hen. This is important when building up a laying strain. The cost of this nest is about 9d., and it is easily constructed, two nests being made out of three kerosene cases.

The gentleman whose picture you see on the screen informed me that his average egg sales in the local market for the past three years were £137 10s. per annum. He keeps six cows for the sole purpose of using the milk for rearing chickens, and for giving to the hens to increase their egg production. The young woman feeding the flock of fowls keeps about 150 head, and her returns from eggs and chickens work out at £26 per year profit after all expenses have been paid, which goes to show the great attention she must have given them, as she was very much handicapped by feeding such a large flock together, and no system being used as regards selection and age. It does not pay to keep a fowl over two years.

Eggs Packed for Export.

Eggs should be packed for export in odourless cardboard fillers. This prevents the eggs from contracting any taint whatever during their storage in cool chambers, or in transit to the London market. The eggs intended for export should be graded to size and colour, each colour being packed separately. This will allow the purchaser to select the colour he prefers, and result in top prices being obtained—brown eggs commanding 2d. per dozen more than the white. Another important matter is to see that all eggs sent in for export are perfectly fresh and clean. There has been a marked improvement in the uniformity and cleanliness of the eggs consigned to Melbourne for cool storage and local use. There is still room for improvement in this direction; strict attention must be paid to the conditions laid down to insure success of the egg industry. This has been borne out by the results obtained from the various trial shipments sent to London from the Government Cool Stores. The consignments were selected and packed with great care, and arrived in excellent condition, being in every way suitable to the requirements of the trade. They were placed on the market in direct competition with fresh eggs, and realized from 1s. to 1s. 2d. per dozen. At the time those eggs were shipped the local market was glutted, and prices were 5d. to 6d. per dozen.

CORRECTION.

Re Mr. Crowe's article on "Systematic Dairying," page 533 of this issue of the *Journal*. Since the first half of the *Journal* went to press, final account sales for pork have come to hand. They show that insurance, exchange, stamps, warehousing, cartage, and dock charges on the consignment, coupled with the expenses referred to in the article (page 539), bring the total deductions to 1.37d. per lb. It may be pointed out that, when selling locally, market dues and 5 per cent. commission have to be paid, as compared with 3½ per cent. brokerage and commission in London; therefore the cost of marketing in London amounts to about 1.07d. per lb. more than in Melbourne.—Editor.

VIII.—RECONSTITUTION OF VINEYARDS.

Francois de Castella, Château Dookie, Dookie.

The subject of this paper is one which can, I fear, only be of practical interest to a limited number of my present audience, for only a few of you are vine-growers, or interested directly in viticulture. When I received the invitation of the Chamber of Agriculture to read a paper on "Viticulture," before the present convention, I had no hesitation as to the selection of my subject, for the question of the reconstitution of our vineyards on phylloxera resistant stocks is the one which at the present time overshadows all others in the minds of our vine-growers.

Viticulture in Victoria has reached a critical period in its history, owing to the recent rapid spread of phylloxera. This pest has now most firmly established itself throughout our vineyards, and its ravages will, within the next few years, lead to a considerable reduction in the wine production of this State. Though checked by efforts at extermination as futile as they were costly, at the time of its first appearance at Geelong in 1875, after a few years it re-appeared at Bendigo, then one of our leading viticultural centres, though the ravages of the insect have practically exterminated it as such. Mooroopna was next attacked, and but for the good work of some of its growers, who deserve credit as pioneers of reconstitution in Australia it would no longer produce wine. More recently still, Rutherglen, the chief stronghold of Victorian viticulture, has been invaded, and is now engaged in a life and death struggle, a struggle which can have but one termination, namely, the destruction of all vines growing on European roots. Protection by insecticide treatment is far too costly to be practicable, and in all districts where phylloxera has made its appearance, it will henceforth only be possible to obtain grapes from vines possessing a root system capable of resisting the insect.

Since we cannot hope to exterminate phylloxera, we must make up our minds to live with it, and to produce grapes in spite of it. We must replace our present vines by resistant ones. This transformation, known as reconstitution, has already been effected in the majority of European vineyards, especially in warm climates, such as Southern France, Spain, Italy, and Portugal, and in the cooler parts where the spread of phylloxera is less rapid, wine-growers are now actively engaged at the same task. In the vast majority of cases the vines eradicated are replaced by grafted ones, a resistant American constituting the stock upon which is grafted a European variety of proved value.

Grafted Vines or Direct Producers?

The fruit of American vines is unfortunately unfit for wine-making purposes; otherwise the problem of reconstitution would be far simpler than it is. Will a perfect "direct producer" ever be raised? Time alone can tell. The results achieved so far, do not inspire much confidence, especially in the direction of the quality of the resulting wine. The best wine made from these new hybrids compares unfavourably with that made from American stocks grafted with even the commoner European sorts. The question has not yet been advanced to a stage which can practically interest Australian vine-growers. Our hope for the future must be centred

in the use of American stocks of proved resistance grafted with the old cepages of Europe.

We must avoid being led away by dreams of reconstitution without grafting, no matter how seductive they may be. It is only by grafting them on to resistant stocks that it will be possible for us to continue the cultivation of these old varieties, the result of the selection of centuries, from which we have in the past produced wine Australians have every reason to be proud of, and this without sacrificing quality in the slightest degree, for it is clearly demonstrated that the fact of their being grafted on roots not their own, leads to no deterioration in the quality of the fruit. The above does not only apply to the wine maker. The safety of growers of raisins, currants, and table grapes also lies in grafting on resistant stocks. Gordos, Zantes, and the choice table varieties all belong to the species *vinifera*, and are just as susceptible to phylloxera as the sorts grown for wine.

Ever since 1876, when it was first proved that the root systems of the American species of *vitis* did not suffer from the presence of phylloxera, French growers have been on the look out for a direct producer, in other words, for a vine capable of resisting phylloxera and of yielding grapes fit to be converted into wine. The discovery of such a vine would, by doing away with the necessity for grafting, enormously simplify matters.

The majority of the American species hybridize freely with European varieties (all of which belong to one species, *vinifera*), and for the past thirty years many leading scientists and practical men, both in Europe and America, have devoted their best efforts to the raising of a hybrid, combining the resistance to phylloxera of the American parent with the quality and abundance of fruit of the European parent. Many thousands of such hybrids have been raised; a good many have been put on the market, and a few are now more or less extensively cultivated with fairly satisfactory results in the cheap wine districts of France.

Considerable progress has no doubt been made, but though the enthusiasm of those who have devoted their life's work to the obtaining of the ideal "direct producer" cannot fail to command our admiration, the success achieved is, as yet, by no means complete. Resistance and quality of fruit seem to be decidedly antagonistic, and in order to secure the one, the other must be, to some extent, sacrificed.

Reconstitution in Apple Culture.

It is now many years since the woolly aphis, an insect belonging to the same family as phylloxera, first compelled apple-growers to work their trees on resistant or blight-proof stocks. No apples are now planted unless rendered secure in this way; the case is almost similar to what we find necessary in viticulture. Reconstitution of our apple orchards has been an unqualified success, no one now troubles himself much about the presence of the once redoubtable American blight. This success in the case of the sister industry is no doubt most reassuring, but we must not lose sight of the fact that the question is considerably more complicated in the case of the vine than in that of the apple. 1st. Apples have always been chiefly grafted, whereas vines were almost invariably propagated by cuttings and consequently grown ungrafted or on their own roots. Grafting was no innovation for the orchadist, nor was it so serious a matter for him owing to the smaller number of trees planted per acre. 2nd. The blight-proof apples used as stocks belong to the same species as the scions grafted on

them, whereas resistant vines belong to species other than *vinifera*, to which, as already mentioned, all European vines belong. It is a well-known fact that the closer the botanical relationship between stock and scion, the better the affinity and the nearer are the conditions of the grafted plant to those of one growing on its own roots, consequently the greater its vitality and the longer its life. For example, a pear grafted on to a seedling pear lives longer and forms a larger and more healthy tree than a pear grafted on a quince or on a hawthorn stock. 3rd. In the case of the apple, the choice of blight-proof stocks is limited. Mr. French mentions twenty in his *Handbook of the Destructive Insects of Victoria*, and of these one alone—the Northern Spy—is more generally used than any other. It seems to thrive in all soils suitable for apple culture, and, when grafted on it, the usual varieties of apple seem to give equally satisfactory results. The vine-grower, on the other hand, has a large number of widely different stocks to select from, for we have to do with several distinct species of indigenous vine coming from various regions of the vast North American Continent, where soils and climates differ in an extreme degree. Of each species there are numerous varieties, and a vast number of hybrids have resulted from the intercrossing of different species, both artificially and in the wild state. Upon a judicious choice the success of the grafted vineyard absolutely depends, for the different stocks differ widely in their suitability to a given soil or climate, and the different European varieties do not all thrive equally well when grafted on the same stock.

Adaptation and Affinity.

We must, therefore, take the utmost care to only plant a stock thoroughly well suited to the soil and climate of each locality, and to only graft it with a variety which has proved itself capable of doing well on that particular stock. The suitability of the stock to soil and climate is known as adaptation, whilst the harmony existing between stock and scion is termed affinity. It is an undeniable fact that adaptation is a more complex question in the case of the American than in that of the European vine; the latter grows well in almost any soil and in widely different climates, but especially as regards their soil requirements, Americans are far more difficult to suit. Though it is possible to find a resistant stock capable of being successfully used in almost any given soil, the matter is one which demands the most careful consideration.

It is a consoling fact that Australians have, so far as adaptation is concerned, one great advantage. I refer to the absence of an excessive proportion of lime in the majority of our soils. An excess of lime has, in many old European districts, been the greatest obstacle to successful reconstitution, for the great majority of American vines show a marked antipathy to a high percentage of this element in the soil. In very calcareous soils most of them suffer from a disease known as chlorosis. The leaves turn yellow, and the plant suffers from a general loss of vigour, rendering it impossible to obtain satisfactory results from it. Though we have little to fear from chlorosis and the evil effects of too much lime, we must not forget that we occasionally suffer from droughts, and many Americans are very susceptible to prolonged dry weather. Some excellent stocks in sufficiently moist soils may prove failures in some of our dry Northern districts.

As regards affinity, we must remember that a vine which gives good results grafted on one stock may not do nearly so well grafted on another.

The operation of grafting accentuates difficulties of adaptation, and insufficient affinity aggravates the trouble. For example, the same vine which may remain green and free from chlorosis in a calcareous soil, if ungrafted, may suffer to some extent even if grafted with a scion for which it possesses considerable affinity, whereas, if this be faulty, the result will certainly be total failure. Adaptation and affinity are thus closely linked together, and the one a necessary complement to the other.

This is not the place, nor does time permit me to deal at length with practical details such as these, no matter how vital their importance: besides, those interested will find full information on the subject in the excellent work of Vialla and Ravaz, *American Vines—their Adaptation, Culture, Grafting, and Propagation,* which was translated by Messrs. Dubois and Wilkinson for the Department of Agriculture.

It is far from my desire to alarm those about to reconstitute. If I have dealt at some length with the difficulties of the problem, it is because I feel convinced that any careless and haphazard attempts at its solution will most probably result in failure and disappointment, whilst if we are careful to avoid mistakes, Reconstitution is destined to be as grand a success here as it has been in France and other countries.

RECONSTITUTION IN FRANCE.

That it has been a magnificent success in France, is one of the most notable facts in contemporary agriculture. The increase in the area under grafted resistant vines during the past thirty years has been enormous.

The following table, taken from the introduction to *American Vines: Their Adaptation, Culture, Grafting, and Propagation* (Vialla and Ravaz), showing the acreage under grafted resistant vines, is very striking:—

1880	16,102
1885	188,230
1890	1,090,045
1900	2,404,895

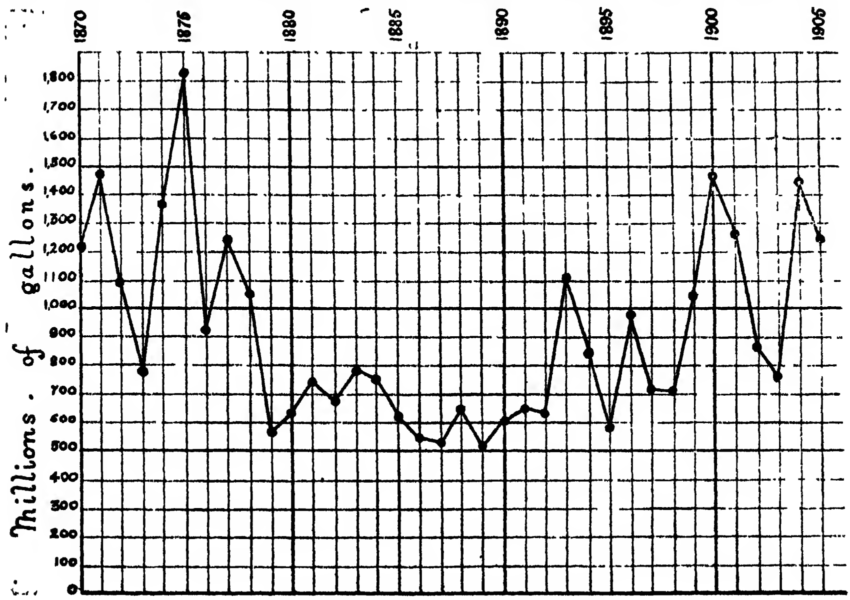
The statistics concerning the total wine yield of the vineyards of France for the past thirty-five years are most instructive. The decrease in the yield from 1878 to 1893, caused by the ravages of phylloxera, is very noticeable; the increase after 1893, due to the coming into bearing of the reconstituted vineyards, is equally striking. The average French yield for the past ten years is just about 1,000 millions of gallons. Previous to reconstitution, during the depression caused by phylloxera, it had dwindled to little more than half that quantity, while the average yield is now practically equal to what it was prior to the appearance of phylloxera. The following chart shows graphically the quantities of wine vintaged each year since 1870.

FRENCH MISTAKES.

The French are undoubtedly the pioneers of reconstitution, and they have paid the usual penalty, that of making many mistakes. Though one cannot help admiring the magnificent recovery made by viticulture in France, the fact must not be lost sight of that it is only by slow degrees that ultimate success has been achieved. Since 1876, when grafting on resistant stocks was first proposed as a solution for the phylloxera problem, until comparatively recently, the history of French reconstitution has been one of failure rather than one of success. Many thousands of acres have been replanted, not once but several times, and of the resistant stocks first proposed and extensively planted, few have stood the test of time. It is

only by carefully noting past failures and avoiding the causes responsible for them, that the vine-growers of France have been able to achieve the splendid results already referred to.

A few of the leading causes of failure in France may be briefly reviewed. In the first place we have insufficient resistance to phylloxera. It is because of its resistance that we employ the American stock at all. To employ any but such kinds as possess this power in a high degree is, to say the least, illogical. Yet the mistake was frequently made in the early days of French reconstitution with disastrous results. Difficulties in adaptation, especially in calcareous soils, led to the use of many stocks which were not pure Americans, or which did not belong to the most resistant species. Many more or less complex hybrids were extensively used, some with a certain amount of *vinifera* sap in their composition.



FRENCH VINTAGES, 1870-1905.

Some of these, at first proposed as direct producers, were subsequently grafted on account of the poor quality of their fruit. Although resisting fairly well when ungrafted, they were no longer able to do so after being grafted; for this operation interferes with resistance in much the same way that it does with adaptation. Fortunately, we now have a large number of stocks to choose from, thoroughly resistant to phylloxera, whether grafted or ungrafted; if we commit the mistake of using stocks deficient in this respect, we will do so with our eyes open.

Quality or Quantity.

One of the most serious mistakes, and one which is the greatest blot on French reconstitution, is the sacrifice of quality to quantity in the majority of the replanted districts.

The great bulk of the wine grown in France is consumed in France. The shrinkage of the yield caused by phylloxera led to a very considerable rise in price. Wine imports increased and artificial wine was largely made.

Wine was at a premium, and even the most inferior kinds sold at very payable prices. The financial results of the first successfully reconstituted vineyards were so encouraging that quality was ruthlessly sacrificed. Instead of using choice varieties as scions, preference was given to those capable of yielding the heaviest crop. The result has been the glutting of the market with enormous quantities of inferior wine. The wine trade is quite demoralized, and periodicals connected with it are loud in their lamentations. The viticultural crisis, as it is termed, is the chief topic in wine-growing centres, and is no doubt the result of the sacrifice of quality to quantity.

Let us profit by the lesson and only plant choice varieties in Australia. Bordeaux, Burgundy, Champagne, and other French districts where choice wines are grown, had the wisdom to graft only their old cepages on to the resistant Americans, and they continue to turn out the wines for which they are famous all over the world. We are most fortunate in having this great object lesson of French reconstitution to guide us. It was the first country infested, and it was French scientists and practical men who found out what phylloxera really was, and who have taught us most of what we know about it and about the wild vines of America, for they have been more exhaustively studied in France than in their native country. Local difficulties will undoubtedly arise, but as regards the main lines of the problem the back of the pioneering work has been broken, and we are in a vastly better position than the unfortunate growers of France thirty, or even fifteen years ago.

AUSTRALIAN MISTAKES.

Reconstitution entails the radical replacement of existing vineyards. It thus gives us a splendid opportunity to correct errors we have made in the past. That many mistakes have been made is well known. Our viticultural industry is not the success that has been anticipated for so many years, and yet few countries have been so well fitted by nature for the cultivation of the vine. That we can, and have produced wines capable of holding their own anywhere has been abundantly proved by prizes awarded at the leading Exhibitions of the world. The recent wine-tasting held under the auspices of the Viticultural Society of Victoria may also be mentioned.

Few agricultural industries are of greater value to a country than viticulture, especially in these days of closer settlement, for few branches of agriculture need so large an expenditure per acre for labour, as is evident from the general prosperity of those districts where the vine is largely cultivated and the comfortable living that can be made off a small area of properly worked vineyard. That the industry should languish is chiefly because we have not worked our vineyards to best advantage. The tendency has, with some noteworthy exceptions, been to plant too large an area, and to work it as cheaply as possible. If the yield was small, at any rate, it did not cost much to obtain. Under such conditions, satisfactory results could not reasonably be expected. Far better to have a vineyard of 20 acres properly established and carefully looked after, than double that area worked on the starvation system, as has too often been done with us in the past.

Deep preliminary cultivation is the first and most important step in the creation of any vineyard, yet thousands of acres of our vines have been planted on soil which received no more preparation than would be necessary for a wheat crop. The necessity for deep preliminary cultivation is

emphasized in the case of grafted American vines. Their roots do not as a rule, plunge so deeply into the ground as those of the old European vines. The fact of grafting also increases the need in this direction. To plant grafted resistant vines on any but properly prepared land, is to court certain failure, more especially in our dry Northern areas. Selection of cuttings has been almost entirely neglected by us in the past, so much so that many of the varieties we cultivate have absolutely deteriorated. Want of attention to the various cultural operations necessary each year is also frequently responsible for unsatisfactory results, but such technical points can only be hinted at here. A very common mistake has been the attempt to produce on one vineyard too many types of wine, each grower trying to be a wine merchant. In old wine countries long experience has taught the type each locality was best suited to produce, and growers confine themselves to the production of that type. In Victoria, each grower has planted a certain area of, perhaps, a dozen different varieties, some of which were quite unsuited to the locality. Hence the production of many nondescript wines of little value.

Our Hopes for the Future.

We must in the first place avoid our own past mistakes. We must also avoid the mistakes made by growers in France and other countries. These have all been placed on record, and are available for us to profit by. The lesson we must remember is that quality must always be our main object. It is only by grafting choice varieties and devoting all our efforts to turning out the best wine possible, that we can hope for ultimate success.

Although old world experience is of the greatest value, it will not do for us to trust to it alone. Australian experience must be our final Court of Appeal. Just as in the case of fertilizers, the information given by the plant itself as to its soil requirements through the medium of experimental plots, is more reliable than that based on chemical analysis alone, so also is it only by careful study of the different stocks in each locality that we can accurately judge as to their suitability or otherwise. We must only plant the best stocks, or those best suited to the conditions under which they will have to grow. We must not be satisfied with stocks which do fairly well. The number of those best suited to any particular locality is, as a rule, limited to a few. The revolution in wheat-growing, brought about by the general use of phosphatic manures is well known. It is the direct outcome of the experimental work carried out by our Agricultural Department. Similar experimental work in the case of resistant stocks will be of the greatest value to our vine-growers. Good work has already been done, and is being done by those who have commenced to reconstitute, and it is only by carefully comparing the results obtained from the use of different stocks under varied conditions that we can hope to proceed on absolutely sound lines and with certainty of success.

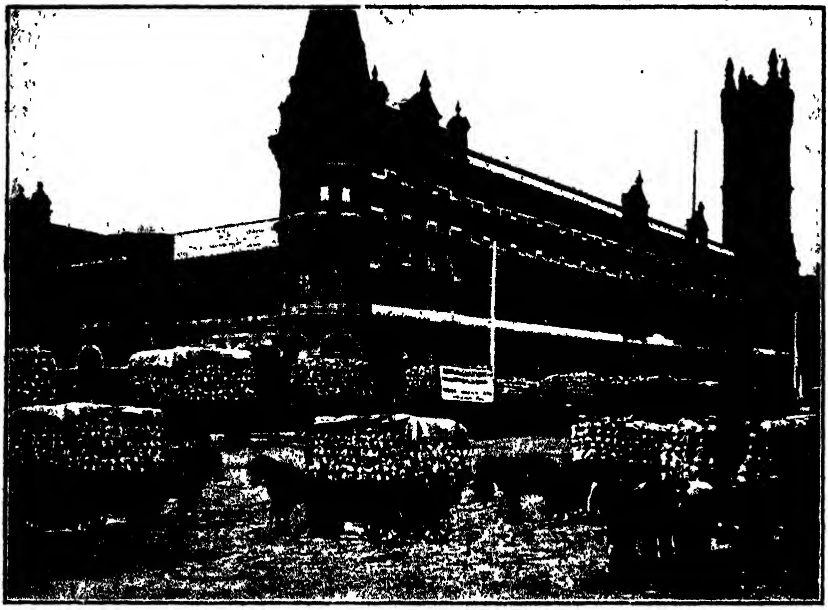
It is my firm belief that phylloxera is not going to wipe out our viticultural industry. If we reconstitute carefully and on correct lines, the industry will emerge from its severe trial, strengthened and improved by the correction of our past errors, and there is not the slightest doubt that our reconstituted vineyards, by the quality of wines they will produce and the financial returns to be obtained from them, will amply repay those who have had sufficient faith in the industry to undertake the task of reconstitution.

The Convention Papers will be continued in the October number of the Journal.

VICTORIA'S GREEN VEGETABLE EXPORT TRADE.

C. French, F.L.S., F.E.S., Government Entomologist.

The geographical position of Victoria is eminently favorable for the production of green vegetable crops, and for years this State has held pride of place as the "cabbage garden" of Australia. The particular portion of Victoria devoted to this class of husbandry is the shire of Moorabbin, which includes Brighton proper, East Brighton, South Brighton, Cheltenham, Mordialloc, Heatherton, Dandenong, Notting Hill, Oakleigh, and Burwood. Cauliflowers are the leading green vegetables grown for

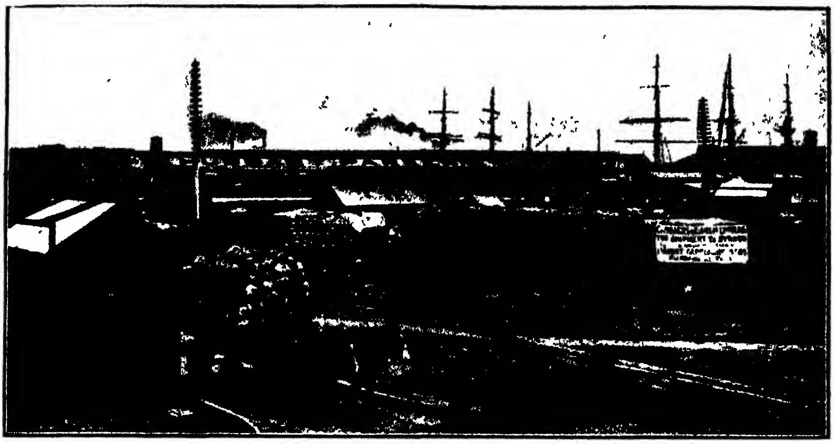


VICTORIAN CABBAGES AND CAULIFLOWERS FOR EXPORT.

export. As against any other exported green vegetable the value is at least five to one. The Sydney market absorbs most of the export output, Brisbane taking the balance. The people of Sydney depend almost entirely on Victoria for their supply of cauliflowers and cabbages. During the past twelve months this State has sent away no less than 87,713 dozens of cauliflowers and cabbages, representing an approximate value of £17,542. The distribution of freight between the railways and shipping companies is about even. As the freight charges are two shillings per dozen by rail, and one shilling and ninepence by boat to Sydney, it will be seen that these vegetables play an important part in the turnover of the railways and the shipping companies. The freights to Brisbane are much higher than those to Sydney, thus it is that Brisbane receives only about one-tenth of the quantity taken by Sydney.

The packing of these vegetables requires a good deal of skill. The loaded waggons are brought in over rough country roads, and the vegetables are stacked (as shown in the illustrations), so that they can solidly resist jolting. A loaded waggon holds about 66 dozen, but some packers have crowded on as many as 70 dozen. The waggons begin to arrive at the

depôt at 7 a.m. The first of the photographs gives a view of the scene outside the Government Cool Stores, taken in the early morning. On arrival at the steamer the vegetables are packed in crates, holding from



AT THE RAILWAY WEIGHBRIDGE.

fifteen to twenty dozen. This packing in crates is not required when sending per rail. Thus a saving of labour is effected, but the freight per rail is higher.

In addition to the business done in vegetables referred to, there is a big trade done with other States in bunch produce, such as turnips, carrots, parsnips, &c., as well as in peas, beans, and vegetable marrows.

LOADING INTO RAILWAY TRUCKS.

An impression prevails that the Chinese are the principal growers in this trade. The proportion of Chinese market gardeners in the State of Victoria is 44 per cent. Out of 4,622 male market gardeners, for the year 1905, 2,022 were Chinese. The great bulk of the vegetables mentioned in this article and shipped to New South Wales and Queensland are grown and despatched by Europeans, as the Chinese mostly dispose of their produce in the local markets, and sometimes by hawking.

The following figures show the volume and value of this trade for the last twelve months:—

Cauliflowers, 73,090 dozen	£14,618
Cabbages, 14,623 dozen	2,924
Bunch produce, 59,400 dozen bunches	2,228
Peas and beans, 280,000 lbs.	1,400
Marrows, 7,400 dozen	925
Total value	£22,095

THE PROCLAIMED PLANTS OF VICTORIA.

(Continued from page 477.)

Alfred J. Ewart, D.Sc., Ph.D., F.L.S., Government Botanist; and J. R. Tovey. Herbarium Assistant.

The Stinkwort.

Inula graveolens, Desf. (*Compsitæ.*)

A hairy viscid (clammy or sticky) much branched, large herb, woody at the base; the lower leaves oblong, lance-shaped, imperfectly toothed; the upper leaves very narrow, and with even margins. This pest is a native of the Mediterranean regions. An alcoholic extract is prepared from the leaves, freed from essential oil, and was known to the ancient Greeks, and is still used in America for amenorrhœa. The demand is, however, exceedingly small, and is amply satisfied from local sources, so that the Stinkwort has no commercial value in this country. It should be pulled up or hoed before flowering. Proclaimed under the Thistle Act for the whole State—April, 1892.

Cape Tulip.

Homeria collina, Vent. (*Irideæ.*)

It has a swollen underground stem, ¾ to 1 inch in diameter, with thick, dark brown, latticed coats. The leaf is linear, stiff, 1½ to 2 feet long. Stem 1 to 1½ feet long, bearing one to four clusters of flowers; their bases are ensheathed by a membranous curled leaf, 2½ to 3 inches long. Floral leaves bright red, with a yellow throat inside, 1¼ to 1½ inches long. Anthers and column each ¼ inch long. Capsule club-shaped, an inch long. *Variety—miniata.* Sweet. Corm, globose, with latticed coats. Lower leaves 1 to 2 feet; linear, rigid. Stem 1 to 1½ feet high, bearing several clusters of flowers. Spathes 1½ to 2 inches long. Floral leaves, fulvous, with a yellow stalk, ¾ to 1 inch long, ¼ inch broad. Anthers shorter than the column. Four varieties of this plant have been described as separate species. The variety *miniata* appears to be more common in Victoria than the type form, and hence the illustration is made from this variety. The Cape Tulip is a native of South Africa. It is poisonous, and should not be allowed to spread. Apart from the abundance of seed, it is also propagated by the innumerable little bulbils (small buds or bulbs) which the plant bears. It should be carefully dug up before it seeds, and burnt with the aid of brushwood or rotted in heaps with quick-lime. Proclaimed under the Thistle Act for the whole State—December, 1895.

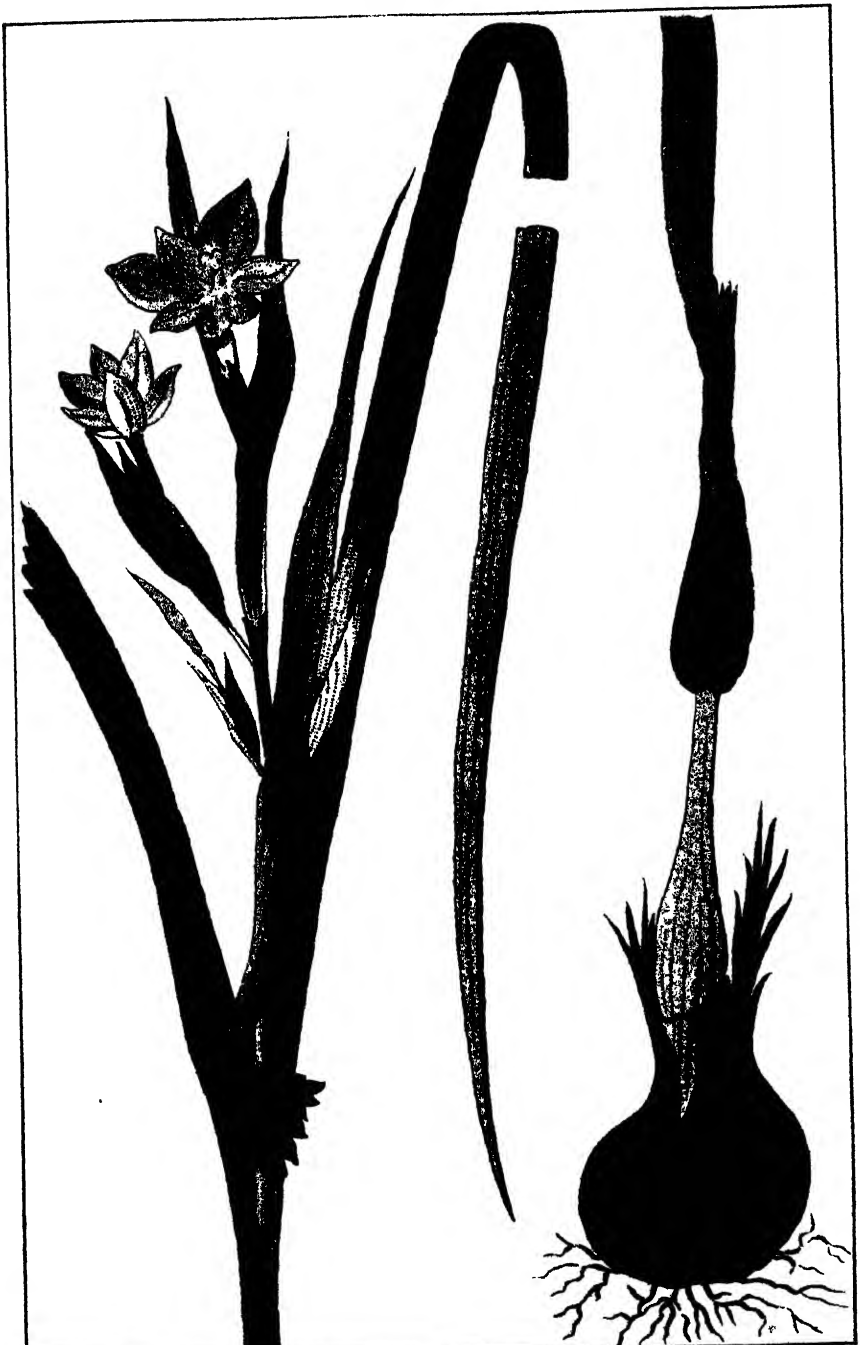
(To be continued.)

PLATE 4.

O Wauer, Del. J. B. Tovey Direxit

STINKWORT.

PLATE 5.



O. Wauer, Del. J. R. Tovey, Direxit.

CAPE TULIP.

DISEASES OF FARM ANIMALS.

S. S. Cameron, M.R.C.V.S., Chief Veterinary Officer.

V.—NOTIFIABLE DISEASES UNDER THE "MILK AND DAIRY SUPERVISION ACT 1905."

(*Continued from Page* 489.)

Contagious Pleuro-Pneumonia of Cattle.

INTRODUCTION INTO AUSTRALIA.

Pleuro-pneumonia was introduced to the continent of Australia from England by means of a shipment of five cattle, imported by Mr. Boadle, of the Plenty River district, and landed in Melbourne during October, 1858. In those days no quarantine period had to be undergone, and shortly after arrival one of the cows sickened, and died six weeks later. Two others of the five succumbed in December and January following, and from that time onwards the cattle on the farm, whether home-bred or introduced, were attacked indiscriminately, three or four dying every month. *Post-mortem* examination of the early cases was made by Mr. H. Wragge, M.R.C.V.S., who diagnosed pleuro-pneumonia, and who was supported in his diagnosis by Messrs. Miscamble and Pottie, veterinary surgeons. It was not, however, until twelve months later (October, 1859) that any effort was made to obliterate the disease. In September of that year the mortality had been so persistent and continuous that in stock circles feeling was roused to the grave danger which threatened, and at a meeting of stock-owners, held at the Port Phillip Farmers' Society office, it was decided to raise a fund for the purpose of purchasing and destroying all the cattle on Mr. Boadle's farm (*vide* the Melbourne *Argus*, 17th September, 1859). This was done, and the farm placed in quarantine, but action had been too long deferred, and the disease spread, and has never since been eradicated. The story goes that the quarantine of the farm and the other measures adopted would have been effective only that a bullock-driver camped his team one night in the infected paddock, and, moving on in the morning, carried infection to other camping grounds, and so spread the disease. Without desire to shatter the romantic halo surrounding an incident so widely believed, and so enchantingly circumstantial, common-sense compels the rejection of the story. At this distance of time, when a critical survey can be calmly made, and in view of an enlightened knowledge of the facility with which the disease spreads, it is hard to believe that during the twelve months, when no restrictions were placed on the movement of cattle to or from the farm, the disease remained confined to Mr. Boadle's property, while immediately on the imposition of quarantine a chance visit of working bullocks should be the means whereby it should make its escape. It suggests a Quixotic resentment on the part of the disease of attempts at the restriction of its liberties; and it is more reasonable to conclude that the rumours which were in existence during the period of inaction, to the effect that the disease had attacked other herds, and was accountable for unusual fatalities which occurred among cattle in the district at the time, had good foundation in fact.

History in Australia.

The history of pleuro-pneumonia in Australia bears out the experience of other countries in regard to this disease and of this country (Australia) in regard to all contagious diseases that have been introduced, viz. :—That on the advent of a new disease to a new soil its virulence, capacity for quick spread, and its death-dealing properties are at first alarming. Later on these characteristics become less pronounced, and when once thoroughly established in its new home, the disease becomes decreasingly less formidable in most respects. On introduction here pleuro-pneumonia was a violently contagious and fatal animal plague, rushing rampant through the land, and involving losses to the extent of 75 per cent. of the animals in the herds attacked. It quickly spread westward to South Australia, and northward through New South Wales to the Gulf country and uttermost parts of Queensland and the Northern Territory, and ever as new country was struck its virulence and mortality was accentuated. Nowadays, however, so greatly has its lethal influence waned, a 30 or 40 per cent. loss in an affected herd is looked upon as a severe visitation.

Unfortunately, the history of the efforts to eradicate the disease or control its spread is a history of crass ignorance and benighted folly, and is illustrative of the cloud of darkness in regard to the nature of diseases of stock with which Australian stock-owners and official authorities allowed themselves to remain enveloped for many years, and which can scarcely yet be said to have lifted. It is a sad reflection that, in spite of the experience of other countries, and in spite also of the scientific veterinary help which was available at the time, as late as 1875, the idea of pleuro-pneumonia being contagious was obstinately and actively opposed. In that year a Royal Commission was appointed to investigate the question of contagion in regard to the disease; and while it was investigating and gathering observations to establish the non-contagious theory, the disease was leaping beyond the practicability of control. The members of the commission were to a man non-contagionists, and they laboured with all the strength of a preconceived opinion to prove their side of the controversy. They brought over healthy cattle from Tasmania, where pleuro-pneumonia had never been, placed them in stalls beside diseased animals, inoculated them in various ways, and then declared their inability to communicate the disease by contagion. They precipitately reported the result to the Legislature, and gave advice, based upon their failure, deprecating further legislative interference. But Nemesis was at hand, for the Government printer's ink was hardly dry upon their report when a counter report came from the butchers of Geelong, who had bought the experimental animals for slaughter, that they were all so diseased with pleuro-pneumonia as to be unfit for human food, and demanding back their money (*vide* the *Australasian*, 1875). While the methods of this commission can hardly be taken as a model in all respects for scientific investigation, the dramatic finale to their experiments was nevertheless convincing, and although the critical period when the disease might have been comparatively easily stamped out was allowed to pass without decisive action, the question of its contagiousness has not since been seriously contested.

Prevalence in Australia.

The absence of published information regarding the known prevalence of the disease in different States, makes it impossible to state with any

degree of definiteness the extent to which the national wealth suffers at the present day from this disease. From 1860 to 1872, however, the average annual loss of cattle from pleuro-pneumonia throughout Australia was recorded at 125,000 head, or a total of one and a half millions during the twelve years, representing a money value in the neighbourhood of ten millions of pounds sterling. It should be explained that this period covered the time when the contagion was operating on new ground with a virulence that has in later years considerably abated; but against any favorable inference that may be drawn from this is to be placed the natural and continuous increase of cattle throughout all the States, as new country has been stocked up; by increase in the number of animals available for infection the disease has greater scope, and its wider spread may be presupposed; so that while the proportion of losses may have lessened, the actual amount is scarcely likely to have done so. Later figures from Queensland seem to support this view. In that State alone during the early nineties it was estimated that the yearly loss amounted to £640,000.

In Victoria, during the first six months of 1904, fourteen outbreaks of pleuro-pneumonia were reported to the Stock Department.

DEFINITION.

PLEURO-PNEUMONIA is a specific, contagious and infectious, communicable and inoculable, febrile disease affecting the bovine species only, localised in the lungs, and characterized by:—

A lengthened period of incubation, high temperature and other febrile symptoms, inflammation of the substance of the lungs and their covering membrane (the pleura) with extensive consolidation of lung tissue and plugging of the air vesicles with exudate, adhesions of the lungs to the chest-wall, and profuse exudations of lymph into the chest cavity (hydro-thorax).

The *period of incubation* of the disease, that is the time elapsing between the contraction of infection and the development of symptoms during which the disease is "brewing," so to speak, varies from three to six weeks as a general rule; sometimes it is lengthened to three months or beyond, and it may be as short as eight days.

CAUSES—ESSENTIAL AND AUXILIARY.

The ESSENTIAL CAUSE is a contagium, or germ, and the contagiousness of the disease was conclusively demonstrated before the aid of present-day bacteriological methods could be invoked. Indeed, such methods have been singularly unsuccessful in regard to the elucidation of the primal cause of the disease until a year or two ago. But practical experience in connexion with the incidence of the disease under all circumstances—whether as a district outbreak or an extension to a new country--has fully established that it occurs only as a result of transmission of contagion from a pre-existing area of infection. This has been the experience in all countries to which the disease has been introduced, and it has been quickly recognised in all such countries, except perhaps Australia, where, as previously stated, for close on twenty years its contagiousness was disputed by men of "practical" repute.

The BACTERIOLOGY of the disease is by no means so complete as to allow of anything but indefinite pronouncement. The germ is one of the smallest yet discovered, requiring a magnification of 2,000 diameters before it can be studied; and it cannot be satisfactorily cultivated on the ordinary media

in the laboratory. It has, however, been artificially grown by an ingenious method devised by Metchnikoff, and practised by Nocard, viz., in a celluloid capsule introduced into the tissues beneath the skin of a living animal. By this unique method of culture, the growth of a minute but actively mobile organism may be observed in about 15 days, which, "when inoculated on cattle, produced the unequivocal phenomena of lung plague (pleuro-pneumonia), in a period of from 8 to 15 days." The late eminent French veterinarian, M. Nocard, devised another method for the separation of the organism from the exudate by filtering under pressure through a Pasteur-Chamberland filter, having a candle of fine porosity. It was found that while all other germs were held back, the pleuro-pneumonia organism filtered through, and cattle inoculated with the filtrate contracted the disease.

Auxiliary Causes.—These may be all such circumstances as tend to the diminution of the normal vigour of the animal and its physiological resistance to the invasion of disease. The existence of other disease or derangement, as, for instance, a "cold," or catarrh of the lungs, or lack of tone during convalescence from such disease will materially assist the determination of an attack of pleuro-pneumonia if the infection is in the vicinity, as will also such depleting influences as over-driving, exposure to cold and wet, and insufficiency of nutritious food. Cows at calving time, and all cattle when undergoing change of coat or when seasons are changing, are more prone to contract infection.

Means of Spread.

The disease is contracted under ordinary circumstances by inhalation only. The infection of paddocks and buildings is generally brought about by the introduction of sick or infected animals; more rarely by other intermediaries—attendants, utensils, fodder, manure, &c. These latter agents, if not disinfected, may be a source of danger for months after contamination, as the infectious agent apparently possesses great powers of resistance, and will live in some media for three or four months, or longer. The disease is infectious from its very beginning, even before any marked symptoms are observable, but the infectious virulence reaches its maximum when the disease is fully developed. Transmission of infection may occur from eight to ten weeks and more from the apparent cessation of an outbreak or recovery of affected animals. In cases where, on recovery, diseased portions of lung have become encysted (cased in or surrounded by a capsule of fibrous tissue), so forming what is called a necrosed centre, infection may occur from such a recovered animal at any time afterwards on the incidence of a cold or any cause resulting in the breaking-down or bursting of the cyst. Thus it often happens that months or years after recovery from an attack an animal may become again infective, and thus also may be explained the occurrence of many outbreaks, which appear to be of spontaneous origin. It is always safer to regard a recovered animal as a potential source of reinfection. Amongst animals in the same building or paddock infection is usually transmitted through the air, and it may be contracted in this way from a distance of 50 yards or more. All cattle are not equally susceptible to the disease; it is usually estimated that the proportion of those which resist attack is about 25 per cent.

Artificial Transmission.

Many experiments have been conducted with the object of conveying the disease by artificial means, for it was desired in the old days to furnish

some such clinching proof of its contagiousness. The Victorian Pleuro-pneumonia Commission, previously adverted to, failed with inoculations, as also did many other investigators, including Willems (in Belgium) and Gamgee (in England), the latter being also unsuccessful by feeding with pieces of diseased lung and injection of lymph into the wind-pipe. In fact, all such attempts failed until the author, in 1890, during experiments conducted at the Melbourne Veterinary College in connexion with the artificial cultivation in calves of pleuro-preventive lymph, discovered that true pleuro-pneumonia could always be set up by hypodermic injection of lymph if the injection was made at a point sufficiently near the entrance to the chest that the swelling induced might extend along the trachea (wind-pipe) to the root of the lungs, and thence into the lung substance. The result, *i.e.*, the setting up of pleuro-pneumonia disease processes, is always the more certain if the experimental animal remains or is kept in the recumbent position during the time the disease is developing, and in this case the disease is most extensive in the undermost lung—a result of the gravitation of the exudate or lymph contained in the progressive swelling. The characteristic lesions of pleuro-pneumonia in the lungs and on the pleura were repeatedly produced in this way, and were vouched for by my then colleague, Mr. W. T. Kendall, M.R.C.V.S., who collaborated in the experiments, and by Mr. Henry Wragge, M.R.C.V.S., Mr. Charles Marson, M.R.C.V.S., Mr. Robert Stirling (Chief Inspector of Stock), Mr. Charles Lynot, and Mr Charles Campbell (Queensland). That the authenticity of the discovery might not be impugned, these gentlemen, all of whom were widely experienced in the disease, certified in writing to the identity of the artificially-produced lesions with those of ordinary pleuro-pneumonia, and that "the marbling and consolidation of the lungs of the inoculated calves was indistinguishable from that found in naturally-contracted pleuro pneumonia."

It was not until the experiments of Nocard, previously mentioned, were carried out in 1897-98 that the artificial transmission of pleuro-pneumonia was again successfully accomplished.

Nature of the Disease.

Pleuro-pneumonia has been usually considered as a systemic disease. But observations made during the prosecution of the author's experiments above referred to seem to force the conclusion that it is a purely local disease—as much local to the lungs as a wound is to the part in which it is situated, or as malignant pustule (localized anthrax) is on the arm of a man. When the virus (lymph) is introduced, whether naturally or artificially, certain inflammatory changes occur successively—congestion, exudation of lymph, perhaps gangrene or sloughing, or perhaps absorption of the lymph—and these changes occur, and are of the same character, no matter at what part of the body the introduction takes place—whether in the tail by inoculation or in the lungs by inhalation—the different appearances presented in each case being solely dependent upon the anatomical character of the tissues concerned. The tissues of the tail being comparatively hard and unyielding, the resulting swelling is also hard, tense, and circumscribed; while, in the soft, spongy tissue of the lungs, the virus produces a correspondingly soft swelling, only physically and not essentially different from that in the tail or any other part inoculated.

My observation was that when lymph was inoculated under the skin behind the elbow the swelling spread by contiguity of tissue in an ever increasing radius from the point of inoculation —back to the flank and thigh, and forward under the shoulder blade up the neck to the jaw, or round the first rib into the chest cavity, and thence to the lungs. Combining this observation with a knowledge of the way in which pleuro-pneumonia lesions in the lung spread, eccentrically from lobule to lobule until the whole lung may be involved, it is a fair deduction that the processes—that artificially produced by inoculation, and that naturally produced by inhalation—are the same, and that therefore before the disease can be set up in the lungs by inhalation there must be a wound, abrasion, or other weakening of the lung tissue or lining membrane of the bronchial tubes, whereby natural inoculation can occur. This would account for the increased susceptibility to contract the disease of animals suffering from a cold or catarrh, and it would also furnish a reasonable explanation of the fact that many animals in an affected herd escape infection.

Course and Symptoms.

Although pleuro-pneumonia may have acute phases, on the whole it is a slow-developing and slow-running disease. From the termination of the period of incubation, during which no symptoms are observable, until death or recovery takes place, a period of from two to eight weeks usually elapses, the average being about four weeks, but in some cases, especially the earlier ones of an outbreak in a newly-infected district, the course of the disease is acute and rapid, and death will occur within a week.

The Symptoms vary as the disease progresses, and it may be as well to make it clear at the outset that all the symptoms here given will not likely be exhibited by any one case or even during any one outbreak, but some or others of them may always be observed, and they are likely to be sufficiently pronounced in character to warrant a diagnosis of pleuro-pneumonia when they are observed in two or three animals simultaneously, or within a short period of each other.

The first symptom observed is usually a short, dry, weak cough, more frequent in the mornings or after drinking, or when the animal rises or changes position or is "bustled." At the same time, the internal temperature is usually increased to 103 or 104 deg. F.; there are slight shivering fits, the coat looks harsh and staring, the muzzle is dry and devoid of "dew," appetite for food and chewing of the cud are partially or totally suspended, but an intense thirst is exhibited, and in milking cows there is a sudden drop in the quantity of milk secreted or a total cessation of secretion. Constipation, with balled and glazed fæces, and scanty, high-coloured urine, are also primary features. While these signs of fever are developing, the animal mopes about listlessly in the neighborhood of trees, under which it stands with back humped, head and neck stuck out, and hind limbs placed forward and apart, with a tendency to knuckle over on one or both hind fetlocks. Although not eating much, it looks fuller than its fellows, and exhibits a peculiar disposition to always face towards the observer, and a disinclination to move away from tree shade. Frequently affected animals exhibit a tendency to rush or horn other animals and attendants, and it is therefore often dangerous to approach them. Later on the cough becomes more pronounced, paroxysmal, and obviously painful. During the coughing spells, the back is arched and the head and neck are

convulsively thrown forward, and between-times a moan or a grunt accompanies the now accelerated and laborious breathing. Each expiratory effort is forced by a distinct flank heave or "tift." The ribs are fixed, and the elbows out-turned. Affected animals seldom lie down, and if they do so it is only for a few moments, during which they always lie on the diseased side—most often the right. There is a discharge of mucus from the nostrils, and the eyes are protruded and glassy looking. The ears, horns, and legs are sometimes hot, at other times cold. When thumb pressure is applied between the ribs there is evident pain and "flinching." The animal is hide-bound, the skin being very tight over the ribs, and any exertion produces great distress. There is rapid falling off in condition, the contour lines of muscles become deeply marked, and the emaciated animal presents a tucked-up and miserable appearance. In-calf cows may abort at this stage. The constipation may continue to the end, or it may be succeeded by a diarrhœa, which, if not profuse or long continued, may be taken as a favorable sign for recovery, indicating, as it does, that the fluid in the chest is being absorbed and eliminated from the system. During this time the pulse is erratic, and of little use as a guide, but the temperature rises, and will usually be found to be 104 deg. F. or 105 deg. F. In some cases, it may reach as high as 107 deg. F. until just before death, when a sudden fall to normal or below is ominous.

For accurate diagnosis the chest sounds on auscultation (with or without the stethoscope) and percussion are all important, and furnish a means whereby veterinary surgeons can oftentimes decide in doubtful or disputed cases. By physical examination of the chest, it may also be ascertained whether there is dropsy of the chest cavity (hydro thorax), and whether therefore a supply of lymph for inoculating purposes could be obtained on slaughter. In such cases a faint tinkling, bubbling, and splashing sound is heard on the movement of the chest wall, and the normal lung murmur is absent

In the last stages of the disease, any of the above detailed symptoms which have been present become exaggerated, the animal falls from weakness, and is unable to rise, and, to the accompaniment of groans and gasps, death results from asphyxia.

In those cases in which recovery occurs, the symptoms moderate about the second week, but convalescence is slow, lasting for several weeks. It is seldom, however, that complete recovery takes place. Although the animal appears to have regained robust health, there usually remains in the lungs an imprisoned mass of morbid matter, from which the disease may break out at any time on the incidence of a cold or catarrh or other cause, and, while not in all cases reinfecting the same animal, the matter set free will cause a fresh outbreak of the disease among animals in contact.

Post-mortem Appearances.

The state of the lungs on *post-mortem* examination varies according as the animal is killed at different stages or dies of the disease. In acute and rapidly fatal cases the lungs are engorged with blood, black or deep purple in colour: they are soft, easily broken down, and loaded with discoloured lymph. In an ordinary case, when the inflammatory process (pneumonia) has become developed, the affected lung is enlarged, solid, and very heavy; the bronchial tubes and air vesicles are blocked with coagulated lymph, so that no air is contained, and the lung sinks in water. The lung has

a consistence like fresh liver, and is as easily torn. The colour, however, is the distinctive feature, or rather the arrangement of colour. On section the cut surface presents the characteristic red "marbling," produced by the yellowish bands of interlobular tissue and exudate surrounding the congested or inflamed lobules. These circumscribed lobules appear like patches of blood-red, brown-red, and dark brown tissue separated from each other by the yellow-red bands, each patch being of a different shade to its neighbour, so that the cut surface presents a colour scheme resembling a piece of smoothened red marble. This is the stage of *red hepatization* or consolidation. In lungs inflamed for a longer time the colour scheme of the lobules is altered to a light-red, yellow-red, and yellowish or whitish-grey in contiguous lobular patches, and the term *grey hepatization* is given. Along with these conditions of the lung substance the pleura (the membrane covering the lungs and lining the chest wall) also presents characteristic features. At first it is merely roughened, but as the disease progresses an exudate is thrown out from it, which coagulates as a yellowish layer of fibrinous material. These layers may be as much as an inch in thickness, one lining the chest wall and the other covering the lung, and they oftentimes become attached to each other, forming fibrous "adhesions" of the lungs to the ribs. In the space between the two layers (the pleural cavity or pouch) is a varying quantity of fluid called "lymph." This is really an inflammatory exudate from the inflamed pleural surfaces. If not contaminated by blood during the opening of the chest this lymph, except for a few flakes in suspension, should be a clear straw-coloured liquid, slightly gummy to the touch, and coagulating into a floppy, jelly-like clot shortly after contact with the air. Lymph of similar quality permeates the diseased lung substance, from the cut surface of which it will ooze freely.

Sometimes on slaughter of an affected animal no lymph will be found in the chest cavity, and the term "dry pleuro" has been coined to designate this condition. There is really no such thing as dry pleuro. In all cases of pleuro-pneumonia at some stage there is exudation of lymph, and when it is not found it has usually been absorbed, such absorption being often evidenced previously by the occurrence of diarrhœa; or it may be that the animal has been slaughtered in the early stages before the lymph has commenced to exude. In any case, some lymph will always be found in the diseased lung substance, and this is equally efficacious for inoculation purposes.

PREVENTION.

Preventive measures include disinfection of premises, isolation or slaughter of affected animals, segregation and inoculation of all healthy contact animals, and quarantine of infected farms or localities.

DISINFECTION must be thorough, and must be applied to *everything* with which infected animals or carcasses have been in contact. It includes cremation methods of disposal of carcasses, litter, manure, forage, and like infection-carriers.

ISOLATION of affected animals should be regarded as a mere tentative measure pending slaughter; for, as has been already indicated, it is bad policy to attempt to cure pleuro-pneumonia or to allow affected animals to recover; they are always a likely means of restarting an outbreak. Isolation of suspected animals is very necessary, but they should be inoculated

without delay. In carrying out isolation, it is of the gravest importance that the healthy animals should be removed from the diseased and suspected —not the diseased and suspected from the healthy—so that the infection may be confined to the one building or paddock.

The length of time during which SEGREGATION, or keeping apart from all other cattle of the remaining healthy animals of a pleuro-infected herd, and QUARANTINE of buildings, paddocks, and farms requires to be imposed, will depend upon intelligent and scientific consideration of a number of circumstances, one of the principal of which is the effectiveness of inoculation. It is here that science-dictated knowledge and level-headed administration comes in. so that, while the essential principles underlying preventive measures are not sacrificed, stock-owners may not be unduly harassed or incommoded.

PREVENTIVE INOCULATION.

INOCULATION is said to have been first practised by the Arabs in olden times. The practice was followed in the beginning of last century in Germany, but it did not gain many adherents until the researches of Willems, in Holland, in 1850, gave the necessary impetus. In Great Britain. Gamgee and Rutherford (the latter of whom gained his experience of the practice in Australia) have been its principal sponsors, but they failed to attract many followers. Inoculation has been more widely practised in Australia than in any other part of the world, thanks largely to the enthusiasm with which it was introduced and advocated by the late Mr. Graham Mitchell, F.R.C.V.S.. whose disinterested and unrewarded efforts in this direction. as in many other directions, were heartily supported by the late Hon. John Stewart, M.R.C.V.S. (M.L.C. in New South Wales), and other professional men.

As to the merits of inoculation, it may be said at once that the Australian experience of it has been such as to warrant full confidence in its effectiveness as an aid in limiting the spread of the disease. Whatever may have been the experience in other countries, there is no doubt that in Australia, from the highest veterinary authorities down to the humblest bullock-driver or "overlander," there is a consensus of faith in inoculation – a faith engendered by repeated proofs of its efficacy and strengthened by experience of the relief it has afforded in thousands of cases from impending financial disaster.

The procedure is simple, so simple, in fact, as to engender a carelessness that at times has resulted in serious harm, such as the transmission of tuberculosis, when lymph from tuberculous lungs has been used, or blood poisoning. The material used is the lymph previously spoken of as occurring abundantly in the chest cavity and in the substance of the lungs. It should be collected free from blood, matter, froth. or other impurities, and should be either used fresh or preserved in sterilized and sealed phials. When used fresh, it is advisable to dilute it one-third or more with sterilized glycerine, otherwise extensive swelling and other serious consequences may result.

The matter of the preservation in effective form of pleuro lymph is an important one in Australia, where it may require to be transmitted great distances for use; and involved in this matter is also the question of the length of time it will remain effective, provided it is preserved from putrefaction. Admixture with glycerine when fresh will usually prevent

deterioration for a period of three weeks or more. It may be kept effective and free from putrefaction for three months or more if placed in sterilized phials or test tubes, with a half-inch layer of sterilized castor oil poured over the surface. Some years ago the author adopted with complete success the method of soaking the threads that are to be used for inoculating in the lymph, and afterwards drying them slowly in an incubator at blood heat. The threads were then placed in sterilized test tubes, plugged with cotton wool, and they could then be depended on for at least three months. Refrigeration of the lymph, or of a piece of pleuro lung containing lymph is another reliable means of preservation. Kept in a freezing chamber at a temperature of 20 deg. F., a pleuro lung will retain its virulence for a year, and the lymph from it at the end of that time will be as effective for inoculation purposes as freshly-taken lymph. Sterilization by filtration through Berkfeldt filter is suggested by Dr. Cherry as a method likely to be successful in that, while the microbe of pleuro-pneumonia will pass through the filter, and so retain to the lymph its virulence, all extraneous germs will be kept back.

The method of inoculation most favoured in Australia—and seeing that it is almost uniformly successful, it will not be necessary to discuss any other—is that by which a short woollen thread previously soaked in the lymph is introduced, stitch-like, under the skin at the tip of the tail by means of a flattened needle, and there allowed to remain. Care should be taken that the tail-tip is clean, and that no dirt or septic matter is introduced. The stitch, *i.e.*, the distance from the point of insertion of the needle to its point of exit, should be from half to three-quarters of an inch, and no deeper than to cause a slight oozing of blood serum. If the needle is allowed to scrape or injure the bone, sloughing of the tail-tip will often ensue.

The first visible effect of inoculation is the formation in about ten days' time of a swelling, which gradually becomes pear-shaped, and may extend some distance up the tail, even to its root. At the same time there is slight febrile disturbance of the system, but otherwise no ill effects are observed. In cases where the inoculation "takes" severely, the inflammatory swelling will be intense, and sometimes the tail, or portion of it, will become gangrenous, and slough off. Sometimes the swelling extends to the rump and quarters, and by pressure upon the evacuatory channels causes retentions of urine and fæces, and death from uræmic poisoning. Ordinarily, the swelling commences to subside at the end of three weeks, and thenceforward the animal is protected against pleuro-pneumonia for a considerable time—a year at least—during which time it is also proof against re-inoculation.

IMMUNITY against the disease may also be naturally acquired. An animal recovered from an attack has acquired an immunity against subsequent attack, which lasts for a lengthened period, and may continue during life.

CULTIVATION OF LYMPH.—Pleuro-pneumonia lymph may be artificially cultivated in calves, and this method of procuring a continuous supply of healthy and uncontaminated lymph is to be commended far before dependence on getting it from affected animals. In fact, its adoption would be essential in prosecuting a campaign for the eradication of the disease. The details of the method of artificial cultivation are intricate, and can only be effectively carried out in a properly equipped zoopathic institution, and by specially experienced veterinary scientists.

ERADICATION.

Pleuro-pneumonia is an essentially eradicable disease. It has been got rid of from the British Isles and also from America, and both these countries have for years enjoyed freedom from the enormous financial losses which its presence entails. The history of the campaign against the disease in the latter country is interesting and encouraging for Australians. It affords evidence of the success that can be compelled by earnest administration of intelligently conceived measures, ably prosecuted by men whose scientific training and practical knowledge of disease processes familiarises them with the methods to be adopted for the suppression of contagion. The success of such methods is as much dependent on correct foundation knowledge of the disease to be dealt with as are the operations of the surgeon on his knowledge of anatomy, or as are modern engineering feats on mathematical and physical science; and it is only from men possessed of such knowledge—as were Salmon and Law, the American veterinary surgeons-in-chief—that success can be reasonably expected. Another absolutely indispensable condition is that the conception and control of any suppressive scheme should be in the hands of a central authority, which could enforce its measures uniformly throughout the length and breadth of the continent, independent of State boundaries. Disease recognises no artificial boundaries, such as exist between the Australian States, and it would be useless for one State to attempt suppression without simultaneous action in each of the other States in which the disease exists. Granted that one State rid itself of the disease, the continuous expense of protecting it on the borders against reincursion of disease would be enormous. It was the futility of independent State efforts that precipitated the successful federal action in America. In 1887 the National and State Governments, being alarmed at pleuro-pneumonia infection having reached Chicago, the largest cattle market in the world, the beginning of the attempt at extinction was seriously undertaken by the Federal Government. The veterinary staff of the Bureau of Animal Industry was organized for the work, and in three months the last acute case was disposed of in Chicago, and the threatened danger to the Continent through the Chicago stock yards removed. This success gave the key to the solution of the problem of eradication, and vigorous suppressive work was followed up in other centres, until early in 1892 the quarantine was raised, and the nation declared free from the disease, and it has remained free ever since. During the campaign 356,404 *post-mortem* examinations were made, and 1,605,721 cattle examined; compensation was paid for 21,961 head. The task was accomplished with an expenditure of under £375,000—a sum less than 5 per cent. of the value of the beef exported yearly; and, to institute an Australian comparison, a sum less than one-half the annual loss that Australia sustained during the twelve years following the introduction of the disease, and little more than one-half of Queensland's annual loss in the early nineties.

The cost of compensation for cattle destroyed would be proportionately less in Australia than America, for the Australian experience of inoculation has, as previously indicated, been such as to warrant the presumption that, with an intelligently-conceived and rigorously-administered scheme of inoculation as preliminary and auxiliary to the stamping-out process, the wholesale slaughtering that was carried out in America would not be necessary.

With such a brilliant object lesson as that of the United States, with its extensive area, its congested stock centres, and its numerous cattle markets, before us, it can scarcely be said that a similar task is not possible of accomplishment in Australia. Rather may the statement be confidently ventured that, controlled by a Federal Department, with the friendly assistance of the present State administrations, and conducted in such a way as to secure the co-operation and help of stock-owners instead of their antipathy, the work could be undertaken with reasonable prospects of success within five years.

GARDEN NOTES.

J. Cronin, Inspector Vegetation Diseases Acts.

The Erica.

The erica, or heath, is a hard-wooded dwarf shrub, most of the species of which are natives of Cape Colony. A number of species are also found in Europe, and the allied species, *Calluna vulgaris*, the heather, and its numerous varieties or forms are natives of the British Islands. *Dabeocia* or *Menziesia polifolia*, commonly called here the Irish heath, is a distinct genus, while the so-called heaths of Australia belong to a different order, *Epacrideæ*. Heaths, especially those from South Africa. are a beautiful class of plants, and the hybridist has added to their beauty and variety. Most of the species are low-growing shrubs, many not exceeding a height of 6 inches; the majority of the garden varieties attain a height of from 2 to 4 feet. *Erica arborea*, the tree heath, is the tallest of the genus, attaining a height of 8 or 10 feet. This heath is a native of South Europe, and its wood is used in making so-called briar smoking pipes, the term briar being a corruption of the French word Bruyère, meaning heath.

Most of the species and varieties of ericas are hardy in this State, inasmuch as they can be grown in the gardens without special protection when well established. Under suitable conditions, they thrive and make fine, free-blooming plants. In the sandy, peaty soil in the Brighton district, they are at home, growing splendidly in many gardens, with practically no attention when once established. A bed of heaths, if the kinds are well chosen, will, at no season of the year, be devoid of bloom, while the plants are neat in growth and evergreen. The flowers of many kinds are beautiful, and wax-like in general appearance, some with long, tubular, drooping flowers arranged on spikes, others smaller, bell-like flowers, arranged in clusters or bunches. The colours are clear and pure, and the flowers last well when cut.

SOIL AND CULTURE.

The most suitable soil for heaths of all classes is a sandy peat. In ordinary loams, even if rather heavy, many of the larger growing varieties

will succeed; but, as a class, they resent manures of all kinds, and whether the soil is sandy or otherwise, they are not likely to grow satisfactorily unless planted in virgin soil. The addition of sand or peat would be decidedly beneficial in heavy soils. In any of the country districts where the soil is of a sandy nature, heaths would succeed if protected from hot and severe winds. In many of the florists' gardens, near Melbourne,

ERICA WILMOREANA, PINK AND WHITE.

ERICA INTERMEDIA, WHITE.

they are grown under most trying conditions; often they are never watered artificially, the only attention given them being an occasional cleaning. and cutting the flowers, and yet they continue to thrive. The most important points in the preparation of a bed, or a position, for heaths are —that no stable manure, bone dust, &c., be used, and that the soil is perfectly drained. Spring and autumn are the most suitable periods for

planting, the plants having a chance of becoming in some slight degree established before the stress of extreme heat or cold arrives. The soil should be firmly pressed before the plants are set out, to prevent any sinking of the surface. Heaths are surface-rooting plants, and this must be borne in mind when planting, for, if planted too deeply, they would probably fail to grow. After cultivation should be watering thoroughly when necessary, and keeping the soil free from weeds. Care should be taken to prevent damage to roots when cultivating near heaths, only the lightest possible skimming, or indeed hand-weeding, being advisable. The only pruning needed is to stop, or thin-out shoots, so that well-balanced plants will be produced. In large established plants, cutting the flowers is practically all the pruning required, removing large or small pieces of growth according to the need of thinning or shortening growths to maintain the symmetry of the specimen.

Varieties.

What are known as the Webbley varieties are among the very best. They are hybrids, raised at Malvern, Victoria, and have become popular for cutting on account of their freedom of flowering and beautiful pink shades of colour. The best are:—"Webbleyana," "W. superba," "Charsleyana," "McKinnoniana," "and "Jubilee." "Intermedia," a pure white, completes a fine set. *Bowieana* (white) and *mammosa* (purple) are also in the same style, and worthy of culture. *Ventricosa* is a beautiful species, of which there are several varieties, the best being *ventricosa magnifica*, *v. superba*, and *v. grandiflora*. These are dwarf in growth, flowering in late spring, of varying shades of pink. Other desirable kinds are:—"Cavendishiana" and "Beaconsfieldiana," yellow; "Wilmoreana," pink and white; "Hybrida," red; *persoluta alba*, white; "Baccans," pink (tall grower); *rubens*, bright rose; and *Cerinthoides coronata*, scarlet (long, tubular flowers).

Flower Garden.

Roses and other plants were more generally infested by aphides last autumn than is usually the case. The winter being mild, a great number of the hibernating insects may be assumed to have survived, and a severe attack on the young growths may be expected. Healthy plants and fine flowers cannot be obtained while myriads of parasitic insects are robbing the plants of their vital forces. The safest and best medium to employ against such insects is tobacco in some form. The best prepared form is "Nikoteen." Tobacco wash prepared from leaf or waste tobacco should not be boiled, as is usual, or the valuable insecticidal properties will be lost. An infusion should be made; cover the tobacco with boiling water, and cover the vessel. The addition of soap at rate of 1 lb. to 5 gallons of water will add to its value as an insecticide directly, and secure its adherence to the insects. A most thorough spraying is necessary, making certain that all parts of the plants are reached. Mildew is also likely to be plentiful on roses, and should be prevented by early use of flowers of sulphur, or spraying with sulphide of potassium, 3 ozs. in 10 gallons of water. The latter may be mixed and applied with the soap and tobacco wash. As growths on roses and other plants are developing, any that are superfluous or badly placed should be removed. By so doing early, the energies of the plant are conserved and directed to the well-placed and required shoots.

Seeds of dahlias and other tender or half-hardy plants may be sown in the open ground, or in boxes, after the danger of being cut back by frost is past. In cold and late districts, it will be advisable to raise such plants in boxes or frames covered with glass, so that an early start may be secured. Dahlias, for instance, require a fairly long season of growth from seed, compared with plants produced from divisions of the crowns, and may not bloom the first season in such districts as Macedon if some early-forcing method is not followed. In the metropolitan district, plants raised from seed sown in beds at the beginning of October are ready to plant out during November, and will flower during March and April. The seed should be sown thinly in well pulverized soil, and covered lightly with sifted soil. If slugs or snails are present, they will destroy the young plants unless prevented. A ring of soot is all that is used as a preventive in many places. Beds previously prepared for the reception of chrysanthemums grown for exhibition blooms should be dug again, and manure added to the soil if necessary. The best time to plant for production of large blooms is October, early or late according to district and variety. Chrysanthemums grown for border decoration may be planted in September

Kitchen Garden.

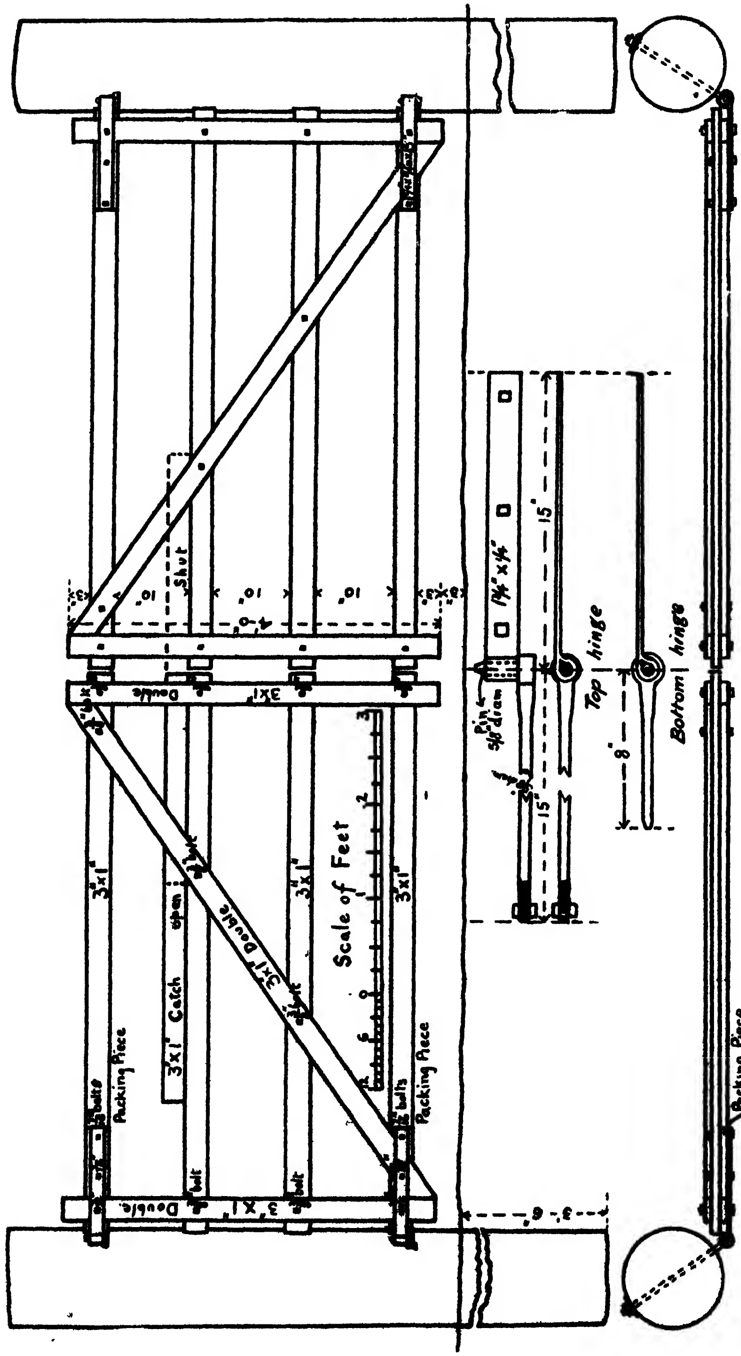
Preparing soil that has been roughly exposed during winter for the reception of seeds and plants from former sowings; breaking down soil for the summer, water-conserving, even surface, and thinning, hoeing, and weeding growing crops, constitute the bulk of the work during the month. Sowings may be made for succession of seed of broad beans and peas, also carrot, parsnip, cabbage, cauliflower, beet, and other crops for summer use. Plants from former sowings may be transplanted. Potatoes may be planted, as also early tomatoes, at end of month.

A SERVICEABLE GATE.

A. S. Kenyon, Engineer for Agriculture.

The most unsatisfactory thing about most farms are the gates. Rarely do they appear to be in good order or working satisfactorily. Ranging from the Mallee lightning gate of one-barbed wire and a stake to the most elaborate mortice-framed iron-stayed structure, it is generally a bother when driving to open or shut them. Defective design, both in undue weight and in framing, is, as a rule, responsible for this state of things. Lightness and stiffness are the essentials, and, leaving out the iron gates now coming into general use, but beyond the ordinary farmer's ability to make, there is none better than the double-batten gate. It is no novelty, having been often described and long in use. There are, however, some points where improvement can be made, and these are incorporated in the drawing herewith. In a gate there are rails, angle braces, and stiles; the stiles to which the hinges are attached are termed hanging stiles, and those with the catch falling stiles. The materials for one pair of 3 in. x 1 in. double-batten gates for an opening of 12 feet are:—

8 rails, 3 in. x 1 in. and 6 ft. long—48 ft.
8 stiles, 3 in. x 1 in. and 4 ft. long—32 ft.
4 angle braces, 3 in. x 1 in. and 6 ft. 6 in. long—26 ft.



Scale of Feet
Packing Piece
3"x1" Catch
Shut
open
3"x1" Double
Double
3"x1"
Top hinge
Bottom hinge
1¾" x ¼"
Pin ⅝" diam
15"
8"

1 catch, 3 in. x 1 in. and 4 ft. 6 in. long—4 ft. 6 in.
4 packing pieces, say, 3 ft. 6 in.
Total 114 running feet, 3 in. x 1 in. hardwood.
4 pairs hinges and gudgeons, as shown.
4 cuphead square-shoulder bolts, 7-16 in. x $3\frac{1}{4}$ wood length.
8 cuphead square-shoulder bolts, 7-16 in. x $2\frac{1}{4}$ wood length.
18 cuphead square-shoulder bolts, 3/8 in. x 3 in. wood length.
All with nuts and washers.

The method of construction is of the simplest. Lay two stiles, hanging and falling, on the ground at the proper distance apart and square; lay the angle brace so that it comes to the ends of stiles; mark it and cut several, as many as required; lay it between the stiles; place the rails in position, as many as desired, and projecting beyond the stiles at each end, and on top of them lay the remaining stiles and the angle brace. A nail or two will hold them in position while holes are bored through for the bolts, and the latter inserted and screwed up. A pair of gates should not occupy in making much over one hour. If many are wanted, a frame should be made and set on the ground, for convenience and saving of time. The points to be borne in mind are to keep the bolt holes as far as possible from the ends of the battens to avoid risk of splitting. This is done by carrying the angle braces to the ends of the stiles, and not to the crossing of the rails and stiles as usual, and by extending the rails beyond the stiles at each end. If the farmer is the proud possessor of a forge and stock and dies, he can make the ironwork for himself. If not, recourse must be had to the local blacksmith. The cost, however, should not exceed about seven shillings for the two pairs of hinges.

In erecting, the gates should be hung to posts independently of the fence. A gate post with wire strained to it will never prove satisfactory. Between the posts a sill log should be set, chocked into each post and just at or a little below the surface of the ground. It serves to keep the posts fixed in position, and is necessary if it is intended to wire-net the gate against rabbits. The gudgeons should be so put in that the gates swing back clear of the posts, leaving the latter to stand any collisions with waggons or implements, which they are better fitted to do than the light gates. The catch consists simply of a piece of 3 in. x 1 in. batten, sufficiently long to extend from one angle brace to the other, between them and the double stiles, and resting on one of the rails. This catch stiffens up the gate so that it is practically one panel. More or less rails may be put in. If fewer than shown, wire-netting stretched over the gate makes it proof against sheep. In positions where the work is light, the top and bottom rails only, with wire-netting between, will be sufficient. Soft wood is, on the whole, preferable to hard wood, as it is about as strong and is considerably lighter. The gates shown weigh about 70 lbs. each in hardwood, and about 50 lbs. in soft wood. The projecting ends of the rails at the falling stiles give room for adjustment when hanging. By the aid of a handsaw they may be made come together as closely as desired, even if the gates are not hung quite true. Never put the angle braces running down from the hanging to the falling stiles; always place them as shown in the drawing. Keep the gates screwed up—once a year at first, and less frequently afterwards. Do not strain wire to your gate posts and expect the gates to hang true. Gates are better painted both to preserve them and for the more ready identification at night time. Cold water paint, Washington whitewash, &c., are better than nothing.

THE ORCHARD.

James Lang, Harcourt.

Orchardists will find this an unusually busy month in getting the orchard into trim, and attending to spraying where required. As pruning and planting are now finished, a start should be made as early as possible with the ploughing of the orchard, which should be continued steadily until completed, while the soil is in a moist condition. If left later, the ground rapidly becomes hard and dry, especially in the drier districts, so that ploughing becomes difficult, and puts a severe strain on the horses. Once the ground has been turned over in the early spring it is always an easy matter to keep it in good condition throughout the summer. Where peas have been sown in the orchard for green manure, it is very necessary that they should be ploughed in while the ground is in a moist condition. Roll them down with a heavy roller; fix a revolving coulter to the plough, and plough in the same way as they have been rolled. Do not roll more than can be ploughed during the day, as the peas will rise again by the next morning, and it is then difficult to roll them flat again. Where it is intended to manure the orchard, a dressing of from 4 to 5 cwt. per acre of orchard manure should be given before ploughing.

Grafting should be done this month. Where old trees are being re-grafted consideration should be given to those varieties suitable for export to oversea markets, because the orchardist will have to depend more and more every year on the export trade to provide a profitable outlet for his surplus fruit. Every opportunity should therefore be taken to increase the quantity of fruit available for export by re-grafting old trees with suitable varieties.

Peach trees will require constant attention to keep the aphis under by spraying with tobacco wash or kerosene emulsion whenever it makes its appearance. Apricots, too, will require spraying with the Bordeaux mixture to destroy the shot-hole fungus. This is best done when the bloom has fallen, and before the leaves shoot out. Apple and pear trees will also require attention towards the end of the month in spraying for the scab (*fusicladium dentriticum*) with the Bordeaux mixture; this should not be neglected in those districts which are affected with this fungus, especially should the spring turn out to be warm and moist, as it is under these conditions that the disease spreads rapidly unless kept in check.

A preventive for bitter pit in apples has so far baffled all our scientific observers in the different States. This is to be regretted, as the disease is going to be a serious trouble to shippers of apples. The fruit is perfectly clean when gathered and packed, but during transit it develops bitter pit, which detracts very much from the value of the fruit when sold. The apples which are shipped early in the season develop the disease much more than those shipped later. Is it because the later shipments are better matured than the earlier ones? All kinds of citrus fruits may now be planted out. Head the plants well back, and secure them to a stake to prevent the wind from blowing them about.

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THE POTATO MOTH.

(*Lita Solanella. Boisd.*)

C. French, F.L.S., F.E.S., Government Entomologist.

In this little moth the potato-grower of many countries has in all probability his very worst insect enemy, not excepting, perhaps, the Colorado beetle itself. The perfect insect is a small, narrow, brown and grey moth, about seven lines across the wings when expanded (see Fig. 1A). The larva is of a pinkish colour, the size being slightly smaller than represented in Fig. 5. Although there exists much difference of opinion as to how the tubers of the potato are first attacked, I must agree entirely with M. Ragouet, of Paris (as quoted by Mr. Meyrick), that "the eggs are laid on the young shoots of the plant; that the larvæ, as soon as hatched, eat into the root stock, and descend until they reach a tuber; and that they remain in this, eating galleries completely through its substance, during the remainder of their larval existence." The larvæ, Mr. Meyrick goes on to say, pupate within their galleries, which they close with silk. These descriptions agree entirely with the results of my own observations and those of practical growers, who have taken the trouble to work the matter out for themselves. Mr. O. Tepper, of Adelaide, a good observer, and an old friend, gives it as his opinion that the female moth deposits her eggs in the stem, just above the ground, thereby bearing out in all the more important details the observations of M. Ragouet, alluded to above.

It has been stated that the insect is not in the potato while the latter is in the ground, and from these remarks we may reasonably infer that the moth is supposed to also deposit her eggs on the potato after being dug. This may or may not be the case, but it is not at all improbable that while in the pit, if exposed, the moths may deposit eggs in the eyes of the tubers, and that the young grubs, when hatched, would at once be able to eat their way into the potato. One thing seems perfectly clear, viz., that it is an almost impossible task for such a minute and fragile moth to descend into the earth, more especially when we find that the damage done is often greater in hard but rich potato land than when the crop is grown on poorer and more sandy soil. Of course, where fissures

occur in the soil, the moth might easily descend below ground. Again, I have received the haulms or stalks of the potato which have been tunnelled by some caterpillar from a foot above ground right down into the tuber.

Some years ago several settlers in the rich Brandy Creek district of South Gippsland sent me samples of potatoes that had been attacked by the caterpillar of this moth, and from which Fig. 4 was taken. This tuber had been cut through in about equal parts, each part containing no less than sixteen and thirteen larvæ respectively. These people complained more of the potatoes having been destroyed while in the pit or raised mound—a fact that could easily be accounted for by finding many of the tubers swarming with grubs, and from which in due time the little moths would appear.

Mr. R. Lucas, of Ensay, an old farmer, and a very keen observer, is quite positive about the eggs being deposited on the stalk of the potato; in fact, he goes so far as to say that he has seen the moth thus deposit her eggs. I have not been so fortunate as this, but I have found the grub in the stalk, and as it was working downwards only, it must necessarily have come from above; at least, such are the conclusions at which I have arrived after a careful consideration of the facts.

Description of Plate.

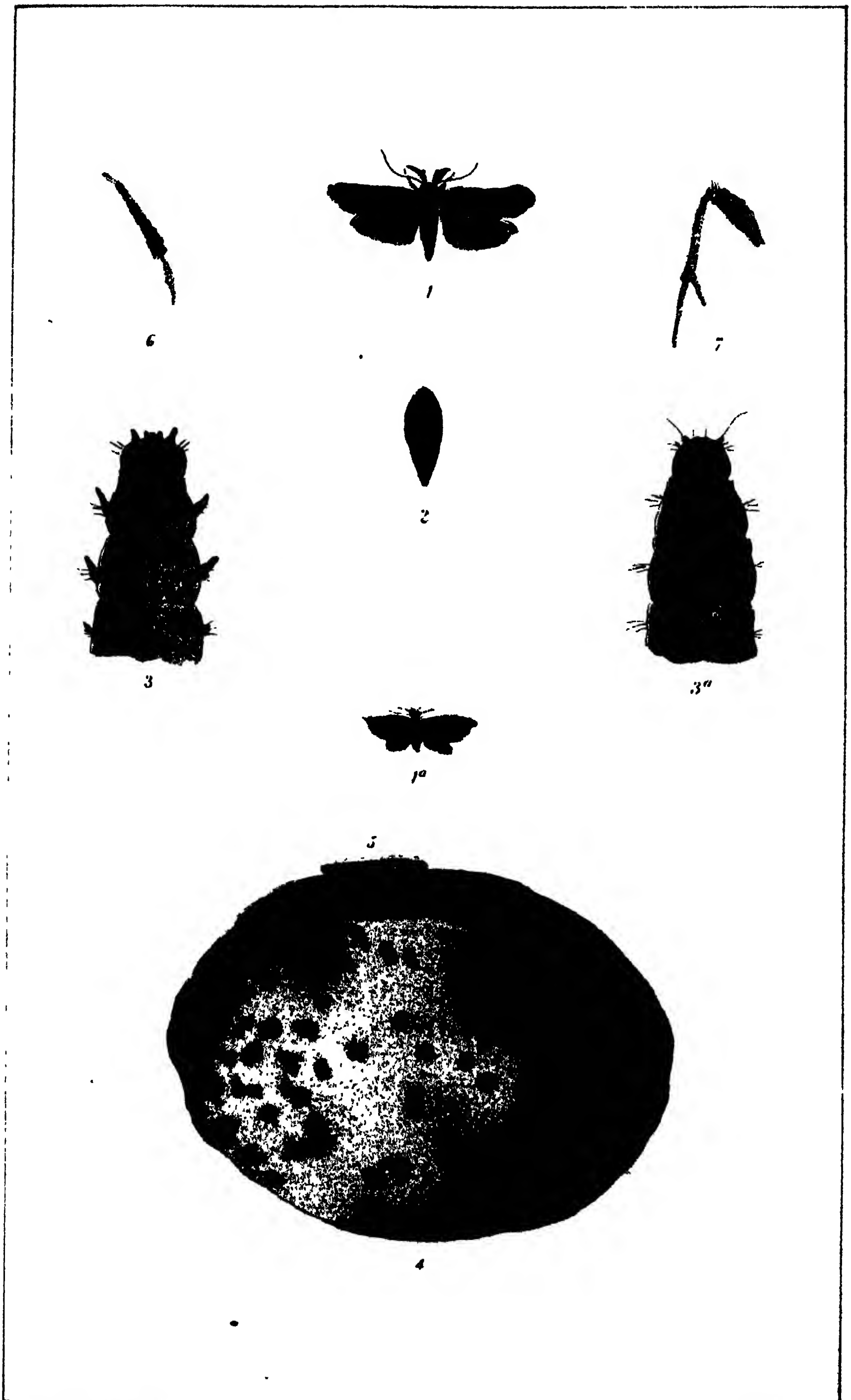
Fig.

1.—Moth. Magnified.
1A.—Moth. Natural size.
2.—Pupa. Magnified.
3.—Head and first three segments of larva upper side. Magnified.
3A.—Head and first three segments of larva under side. Magnified.
4.—Potato sliced to show effects of attack by larvæ of moth. Natural size.
5.—Larva. Slightly enlarged.
6.—Fore-leg. Moth.
7.—Hind-leg. Moth.

In dealing with a pest of this kind, we must at once admit the great value of a thoroughly exhaustive study of matters connected with life-histories of insects, and this can only be done by those having time or being on the spot. It is here, therefore, we see more than anywhere the great value of "Field Agents"—entomologists whose duties lie exclusively in visiting infested districts, and who endeavour by every means in their power to fully investigate and report on facts connected with the life-history, parasites, &c., of any particular pest that may make its appearance. Such institutions practically exist in America only, where they have means, population, and resources to carry on what is really a most necessary and useful, although sometimes costly, series of observations. How much can be done in this direction has been amply proved by the visit to Australia of my friend and fellow-worker, Mr. A. Koebele, whose valuable services have been recognized by the growers of the United States, over whose Entomological Department, Dr. L. O. Howard, so ably and admirably presides.

The history of the cottony-cushion-scale in America, the damage caused by its ravages, and the introduction of its natural enemy, the Australian ladybird (*Novius cardinalis*), are now matters of history, and furnish one of the many practical illustrations of the value of an Entomological Department in any country where fruit-growing plays an important part in the every-day life of a portion of its people.

But, to return to the potato moth and its habits. It may again be stated that the greatest importance is attached to any discovery that can shed additional light upon the life-history of this most serious pest. The



C C Brittlebank, Del.   C French, Direxit

damage done to our potato crops in Victoria alone is almost beyond calculation; but knowing now fairly well where and how the eggs are deposited, should be of great assistance to growers and others when devising means for its destruction, more especially whilst the insect is in its earlier stages.

According to Boisduval, as quoted by Meyrick, and alluded to by Tryon, in certain districts of Algiers, during a single season, three-fourths of the potato crop was destroyed by this pest, and Mr. Tepper, of Adelaide, says:—"As far as my continued observation goes, the insect causes now, in its immature form of the caterpillar or grub, the destruction of hundreds of tons of potatoes every year by boring them, and thereby inducing putridity." Again, that these moths occur in other situations less confined than the entomologist's hatching case, was gleaned latterly from the information a farmer gave to me when speaking on the subject. He said that "he had several bags of potatoes, of his own production and quite healthy when dug, placed in his store-room, where they were left undisturbed for a considerable time. When he at last came to open a bag for use, quite a swarm of little moths greeted the event, and, to his surprise, he found the tubers spoiled by the grubs to a great extent." So far as can be ascertained, there is no record of the natural home of this pest; but Mr. Meyrick remarks:—"It does not seem to have been noticed in the home of the potato (America), and it is therefore, perhaps, more likely that it feeds naturally on some species of *Solanum* in the inland regions of Africa, and has spread thence on a congenial food plant being brought to meet it."

We have thus seen how much opinions differ as to the mode of attack practised by these moths, and Mr. T. Searle, in replying to questions as quoted by Mr. Tryon, states:—"I am perfectly sure that the insect is not in the potato while this is in the ground. We are almost daily using potatoes which were all dug up at one time, immediately picked up, and placed in a dry-goods cask, in which straw was placed between each layer of tubers. The cask is covered up by a corn bag, and, with the exception of a few near the top of it, none are affected by the moth." In Tasmania it was "invariably found that the moth attacks the roots. The uppermost potatoes—those that are nearest the surface—are, of course, more easily reached; nor is it by any means a difficult matter for the insects to penetrate to a depth of 3 or 4 inches where the soil is open, uncompressed, or lumpy. Not a single case of an infested stalk has yet been detected, but constant and numberless have been the instances in which, when uncovering the potatoes at the depths just indicated, moths have been dislodged, and have flown away uninjured." It has thus been, we may say, fairly shown that there still exists some doubt which ought, in the interests of growers, to be cleared up as soon as possible, as to whether the depositing of the eggs is confined to the stalks of the potato, or whether the tuber is also attacked while below or above ground, as a correct knowledge of these facts, which have been attested to by so many good observers, would be of the greatest value in helping us to devise some speedy and direct method of attacking the enemy in its earlier stages, and thus prevent the egg-laying.

In Queensland, as reported some time ago by Mr. Tryon, this moth has also been found attacking the tobacco plant. We must, therefore, be on the look-out, as tobacco plantations in Victoria may also be in danger of a similar visitation.

Prevention and Remedies.

In the first place, we must try to get rid of the moths themselves, and to accomplish this we should use the knowledge already possessed. As we are certain of this insect being a night-flyer, the first plan that suggests itself is undoubtedly that of some cheap and effective lamp. In this connexion I may mention a letter which I received from Mr. R. Lucas, who says:—"My plan is simple, homely, and at hand at all times, without the cost of a shilling. All that is wanted is a common tin soup-plate, a clay wick-holder in which to burn fat, and a short wick an inch in diameter made of any cotton stuff. The wick-holder should not be higher than the rim of the plate, and be made to stand in the plate in its four lower corners, to enable the fat to gain access to the wick. The fat is best made hot at the first lighting of the lamp; the burning wick heats the clay wick-holder and keeps the fat in a liquid state. The moths fly to the light, drop into the hot fat, and are destroyed. The lamps require lighting about dusk in the evening."

That these moths will be attracted by a light I have proved myself, so that I feel quite justified in quoting the experiences of Mr. Lucas, as above. Here we have a remedy that may be termed a preventive one, and is one that growers can, without any outlay worth mentioning, use for themselves, as, should it be found that the moths can descend into the soil, they will in most cases be able to as readily ascend. If the egg laying is confined to the stems and young shoots, as supposed by Mr. Tepper and many others of our best observers, the "lamp" plan will answer all the same, and probably better

The next point to be considered is, how to treat the tubers, supposing the grubs to have already got at them? This would appear to be a most difficult matter, and probably the best advice that can be given would be to keep your lands as clear from weeds and rubbish as possible. Use none but clean sets, which, to be on the safe side, might be planted at a greater depth than usual. Pay great attention to deep and careful earthing, and, after digging, get the tubers off the ground and bag them as soon as possible. When in the pit keep them well turned over, and be careful to destroy any badly-infested tuber, as from these the moths will hatch, only to commence their depredations in another place.

Lime, if judiciously used when the potatoes are in the pits, has a good effect. Seed potatoes should be carefully examined before planting out. After the crop has been dug, more especially on land where the moths are known to exist, if at all possible, a good dressing of gas-lime, at the rate of, say, 30 bushels per acre, would be of much benefit. This must, however, as advised by the late Chemist for Agriculture, Mr. A. N. Pearson, be exposed for some weeks to the air before using. Air-slaked lime, if well harrowed in before planting the sets, has been tried and found to be of very great use, and a change of soil has also its advantages.

Mr. Tepper suggests that the tubers, prior to storing, should be washed clean and bathed in some solution which might be distasteful to moths or their progeny, and mentions the use of weak salt or sulphuric acid solutions. Mr. Tryon, however, thinks that alum would be more suitable, and I am inclined to agree with him in this respect. It is feared, however, that in a country where potatoes are often sold at so low a figure, that the methods proposed by the gentlemen referred to, would be somewhat too expensive for general use. Still, for those tubers which

are intended for seed purposes, it might be carried out with advantage by those having facilities for doing so.

Most excellent results have been obtained by spraying both the tops and the tubers themselves with Paris Green (paste form)—1 lb. Paris Green, 6 lbs. lime, diluted with 200 gallons of water—but for spraying, the lands should be so arranged to admit of a horse sprayer being driven between them. The spraying should be done as soon as the young shoots have sufficiently ripened, and again at intervals as circumstances demand. A spraying before being pitted would also be of service. I have saved hundreds of acres of potatoes from other caterpillars by simply spraying the foliage twice during growth.

The slush-lamp system should have a good trial, and must be placed in a growing crop (Mr. Lucas thinks when in flower), also amongst the pits in which the tubers are usually stored. One drawback, however, to the use of the slush-lamp is, that large numbers of ichneumons, "lace-wings," and other useful insects are also attracted by the light, and, of course, killed.

In this age of wonderful discoveries it would not be too much to expect, or, at least, hope, that resistant kinds of potatoes may yet become general, in which case many of our troubles with these pests, at least, will be removed.

The failure, even if only partial, of our potato crops, is a serious matter for any community. In helping each other with advice, and the results of our experiences, we may be able to considerably reduce the damage done by this widespread and destructive little insect. We must have, in addition to our own experiences, the co-operation of the growers themselves.

The use of the tarred canvas frame would also be of great advantage, as immense numbers of moths of many kinds may be captured by its adoption. Take some light battens (soft wood is the lightest and best for the purpose), cut them into 5 ft. lengths, fasten together at the corners, and on this frame, to which should be attached a long handle, stretch some stout calico or light canvas, the latter being the more desirable. Smear the underside of the canvas with tar, which must be put on cold, and without having been heated. With this machine go through your growing crops, also amongst pits and bagged potatoes. If this canvas frame be judiciously used, a vast number of moths can be destroyed. This plan has been found to answer well in the case of the cabbage moth, but in treating for the latter the plants should first be struck with a bunch of twigs to cause the moths to rise. One trial of this plan will be sufficient to convince any reasonable person of its efficacy.

Before closing these remarks on this pest, it is advised, where at all practicable—and there really seems to be no insuperable obstacle to this being carried out—that the lands on which the potatoes are planted be so arranged that a machine, such as the Strawsonizer or the one invented by Mr. Pearson, could be used for the purpose of distributing tar or other cheap insecticides in a liquid form, such as before described. It is well known that tar in any form is particularly obnoxious to insects of most kinds, and by a timely application of such the moths may be prevented from depositing their eggs. If tobacco plants should be attacked, a light spraying of white hellebore, mixed in the proportion of about 1 lb. to 30 gallons of water, would be effectual in destroying the grubs. Any of the introduced *Solanæ*, such as the "Sodom apple,"

nightshade, and others, should be rooted up and destroyed by burning, these being not only breeding plants for many of the smaller moths, but, when the fruits are eaten, are most injurious to children, also to stock, and should never be allowed to grow within miles of either farms, orchards, vineyards, or gardens of any sort. The introduction of noxious, and often poisonous, weeds into these States has been a real calamity, as in several cases the advent of destructive insects may be traced to their agency.

POTATO EXPERIMENTS AT BUNYIP, 1905-6.

D. McAlpine, Vegetable Pathologist.

The experiments were continued from the previous season, and the main object was to test the effect of different treatments in the prevention of various diseases, especially that known as brown ring, which is very prevalent in some years in the variety known as Beauty of Hebron. The treatment consisted in the application of various substances to the seed, and spraying the plants when above ground. The substances used for the seed were corrosive sublimate, formalin, bluestone, sulphate of iron, and lime and sulphur mixed. All the "steeps" were applied to the potatoes before being cut, and the sets were allowed to dry before planting.

Owing to the dry season the brown ring did not appear either in the treated or untreated plots, but the experiments served to show the substances which might be safely used in anticipation of their being employed for other diseases. Thus a solution of formalin or corrosive sublimate is a well-known preventive for "scab," and the tubers were soaked for two hours before planting either in corrosive sublimate solution at the rate of 2½ ozs. in 15 gallons of water, or in formalin at the rate of 1 lb. in 30 gallons of water. A small quantity of "scabby" potatoes were planted, and it was found that the scab appeared in the produce, thus showing the necessity for planting tubers which are perfectly healthy, and free from disease.

The spray used was Bordeaux mixture, consisting of 4½ lbs. bluestone, 4 lbs. fresh lime, and 30 gallons of water. Poisoned Bordeaux mixture was also tried with Paris green added at the rate of about 1 oz. for every 10 gallons of water. Spraying has now become a regular and profitable practice with the orchardist, and in view of the possibility of the potato disease reaching us from New Zealand, it is well to know that this disease can be largely controlled by spraying the potato tops. And not only is Bordeaux mixture used for combating the majority of plant diseases due to fungi, but it has the further useful property of enabling the sprayed plants to retain their foliage for a longer period than they otherwise would. On this account the plant is able to extend the growing period, store up more material in the tubers, and thereby increase the yield. The gain due to the spray, as shown in these experiments, is far more than sufficient to repay the cost, and this fact should help the practice to be all the more readily adopted for the prevention of disease.

The accompanying table gives the total yield per acre, and the percentage of large potatoes obtained as a result of the various treatments. The planting was done during the first week of December, and the digging in the first week of May, being a little late owing to the dry season. The

average yield in the check plots was 2 tons 3½ cwt., and this will be the standard of comparison in judging the effects of the different treatments on the yield. The highest yield was 3 tons 8¾ cwt., from seed treated with bluestone powder, and afterwards spraying the plants with Bordeaux mixture. The lowest yield, and the only one below the check, was 2 tons 1½ cwt., from seed treated with corrosive sublimate, while formalin-treated seed yielded about 6 cwt. more. The sulphate of iron dip consisted of 1 lb. to 3 gallons of water, and whole sets were steeped for two hours, but none grew, and seed treated with this strength was evidently killed. Where sulphate of iron was used in the form of a powder, the seed grew all right, and yielded 2 tons 13¾ cwt. The spraying with Bordeaux mixture on 22nd February was very successful as regards yield. With untreated seed, but plants afterwards sprayed, the yield was 11¾ cwt. above the check, and where the seed was treated with bluestone powder, in addition to spraying, the gain was 1 ton 5¼ cwt. The increase from spraying was not only due to the extended period of growth, but from its checking the development of such diseases as early blight, which appeared in some of the untreated plots.

Plot.	Treatment.	Large.	Small.	Total.	Large	Total per acre.
		lbs.	lbs.	lbs.	per cent.	ton cwt. qr.
1	Corrosive sublimate dip for seed ...	235	75	310	76	2 1 2
2	Formalin dip for seed	295	58	353	83	2 7 1
3	Check	223	63	286	78	1 18 1
4	Seed untreated—Bordeaux spray in February	347	66	413	84	2 15 1
5A	Bluestone powder sown with seed ...	170	62	232	73	3 2 0
5B	Bluestone powder sown with seed and sprayed	193	64	257	75	3 8 3
6	Check	280	84	364	77	2 8 3
7	Sulphate of iron dip for seed... ...	—	—	—	—	—
8	Sulphate of iron powder sown with seed	314	87	401	78	2 13 3
9	Lime and sulphur powder sown with seed	246	88	334	74	2 4 3

NOTE.—Plots 5A and 5B are only half the size of the others.

FRUIT TREE MAKING.—WHAT TO PLANT.

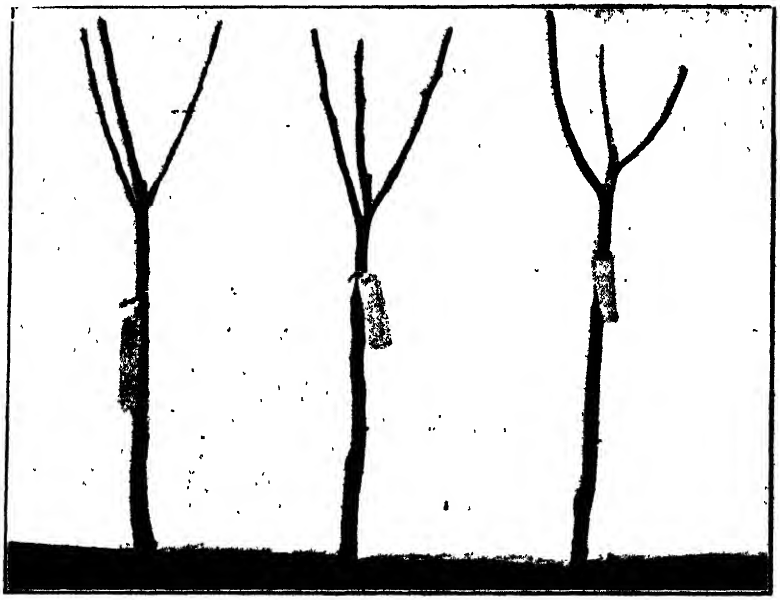
A. G. Campbell, Assistant, School of Horticulture, Burnley.

The success of an orchard, like that of a farm, after the site has been selected, must depend upon the quality of the material used to stock it. This is a primary principle, and, therefore, of no small importance. Apart from variety, which may be according to the wish of the owner, or the requirements of the market, there is the vigour of the stock to be considered; and vigour and health are what stand at the back of all else that can be expected from any living things. Too often orchards, or parts of orchards in poor places, have failed simply because the trees were not vigorous enough to meet the demands made upon them by the situation. Whereas, had they been a degree or two more vigorous, they would have

been alive and profitable to-day. Youth is the critical time; if the rule is recognised and acted upon in connexion with farm animals, why not with fruit trees?

THE PUBLIC TASTE.

The making or marring of the orchards of the future lies in the nature of the young trees, which are turned out by tens of thousands annually from the nurseries in several parts of the State. The public demand is at present for a large tree to plant out, even three-year-olds being asked for in some instances. But it is a fact that the larger the tree the less kindly it takes to transplanting. It is not to be supposed that a tree that has made good its foothold into the soil, and has adapted itself



TYPE OF TREE ON THE MARKET TO-DAY.

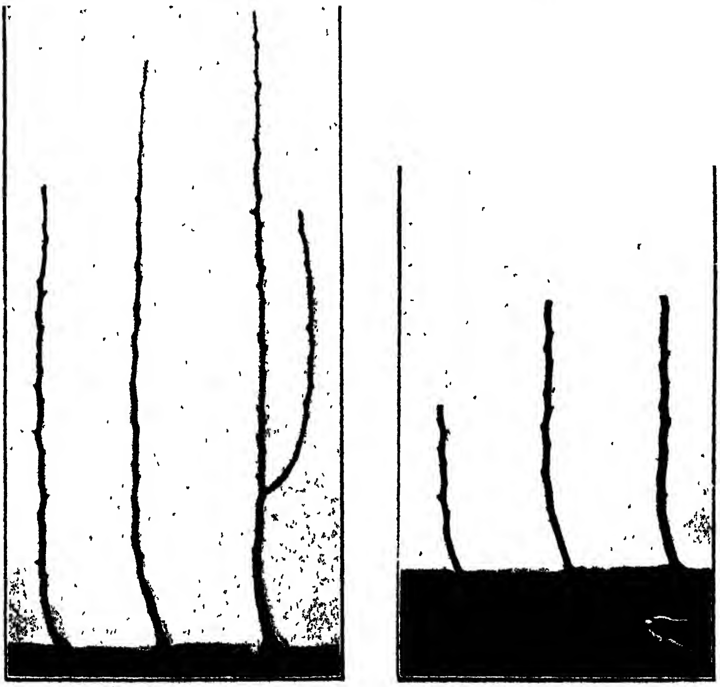
to the climatic conditions, will take so kindly to removal as one not in that condition. It has been proved that the yearling tree gives the best results. Further, in order to comply with the public demand, the growing stems of young trees are pinched in order to make them throw out second growth to form a large head. Though this head may be large in appearance, and seem "a lot for the money," it is not so in vigour and in quality. Shoots, which are forced as late as December, cannot be equal to those that take full six months to mature, and shoots of this "unripe" character can never form the basis of a sound head to the fruit tree.

Again, the headed tree is already formed as far as the trunk is concerned. The trunk can neither be lengthened nor shortened, and must remain at the eighteen inches or two feet allotted it in the nursery. It is folly to plant an orchard of mixed varieties on one length of trunk. Strong varieties may be too powerful, and weak varieties too sickly to fruit well if both are on a two-feet trunk. The trunk must be allotted according to the inherent nature of the tree; a Jonathan apple, for instance, on a one-foot stem, and a William's Bon Chretien pear on a three-feet stem, would

both, under similar treatment, give an equal profitable result. Any given variety of tree, also, if planted out of its natural climate, that is, to the north or to the south of conditions best suited to it, must have its trunk shortened in proportion; so the fruit-tree planter should aim at giving his transplanted trees as little check as possible, and he should also have it in his power to make the trunks of whatever length he deems necessary in his district.

THE KIND OF TREE TO PLANT.

The kind of tree suited to these requirements is undoubtedly the yearling whip, that is the season's clean growth from the bud (which should be near the ground), not interfered with in any way during growth. The growing of this whip entails absolutely no work in heading and trimming, and



Unpruned. Pruned according to length of trunk required.

THE BEST TYPE OF FRUIT TREE TO PLANT.

so the cost of production is considerably reduced. Nature is allowed to produce the yearling tree in her own way, and no improvement on this can be imagined. There are other advantages which tell heavily in favour of both the nurseryman and the buyer. Besides being cheaper to rear, as well as stronger in constitution, these yearlings are, in the replanting season, very much easier to handle. They are compact in growth, and light in bulk, easy to pack, and cheap to carry.

There are, however, some difficulties to consider by the way. Many varieties will not throw clean whips in the nursery under the existing conditions of open planting for cultivation. They spurt laterally from a number of the buds. This is a sign of vigor to be welcomed in young trees. The apex of the shoot, growing upward as fast as possible, is

still not able to absorb all the sap sent up from the roots, so the surplus must break out in other parts. Strong shoots at the top of a young fruit tree often behave similarly, while those in more crowded parts remain as single whips. There are two ways of treating these growths. In most varieties they can be cut, in the pruning season, cleanly away, and there are found at their base one or two developed buds ready for growth in spring. Or, if these base buds are not present, the three best branchlets, about the height at which the trunk is to be cut, can be left and pruned to throw shoots for the permanent branches. In this latter case, the shoots thrown from these branchlets will be vastly superior in quality to those thrown from the pruned second growth of headed trees.

HOW TO OBTAIN THE BEST TREE.

If the intending planter waits until next winter before ordering his trees, he will find it impossible to obtain any large supply of yearling whips. All the nursery stock has been headed during the growing season, and only those too small and weak at the time when such treatment is given, are left to grow a single rod. Arrangement, however, can be made with some advanced nurseryman to let well alone, and for as many hundreds of such varieties as may be required, to be delivered next winter as straight whips four to six feet long, or if with side spurts so much the better. This agreement should be made now as the season of growth will soon be round.

CASTRATION OF FARM ANIMALS.

S. S. Cameron, M.R.C.V.S., Chief Veterinary Officer.

Colts are customarily castrated as yearlings; calves and lambs at any age up to a year, and pigs at four to six weeks. Amongst racers, horses are "added to the list of geldings" at almost any age, and occasionally stallions of other breeds are "cut" and bulls are made "stags" of at a later period of life. The operation is the same in all cases except that with aged horses in full condition a little extra care in providing for the arrest of bleeding is necessary, and for this reason, as also because of the liability of aged animals to fracture of bones, the "standing operation" is often preferred in such cases. The standing operation is safer for the animal, if not for the operator, and doubtless as time goes on this method will become customary when dealing with valuable or high-mettled animals of all ages.

It is advisable that the subjects should be kept without food for twelve hours or more before being operated on, and racehorses in training should be thrown out of work, and stallions in high condition reduced by soft diet for several days before. A further very necessary precaution prior to the operation is to handle the scrotum or purse while the animal is upright, so as to know that both testicles are "down," and that there is no rupture. When this precaution has been neglected, colts are occasionally lost through protrusion of the bowels after castration, and such losses are altogether inexcusable.

CASTRATION IN THE RECUMBENT POSITION.—The usual method of "throwing" for castration is with "side-lines," *i.e.*, a collar and heel ropes, made by forming a loop midway between the ends of a long rope, the loop being used as a collar and the ends of the rope passed round the hind pasterns, or, if chafing of the pasterns is to be avoided, the ropes are passed through rings in hobble straps, put on to the hind pasterns. The rope ends are then taken forward, passed under the rope collar at the shoulder, and then pulled on from the rear, when the colt, after a struggle or two will be thrown gently on his side, with the hind limbs drawn up towards the shoulder. An assistant should keep the head steady on the ground, while the two hind limbs are secured with a couple of half-hitches of the heel rope. The uppermost fore limbs may also be secured with the same rope, or with a strap.

Before operating, it is customary to take this opportunity to remove any accumulated wax from the sheath, and to wash it, and also the penis with soap and water, or with an antiseptic solution—say, one tablespoonful of lysol or creolin to a gallon of water. The skin of the scrotum and inner aspect of the thighs should also be similarly washed, and the operator's hands and instruments should be scrupulously clean--made sterile, in fact, by washing in hot water and washing soda or other disinfectant solution.

The testicles are usually odd in size, and it is advisable to incise for the smaller one first, for it is often drawn up and difficult to find after the larger one has been let out. The testicle to be excised should be grasped between the finger and thumb of the left hand from the front, and the skin of the scrotum covering it made tense. With the castrating knife in the right hand, a bold incision is made in the direction of the long axis of the testicle, just sufficiently deep to cut through the skin and testicular coverings, and expose the testicle but not wound it. The incision should be made sufficiently long to allow the testicle to slip out without difficulty; not that the squeezing of the testicle through a small opening is untoward, but in order that, afterwards, free drainage of dis charges from the wound may be provided. If the wound made is a small one, the edges are inclined to curl up and cause a "pocketing" of blood and discharges, and, in the majority of instances, it is the retention of discharges so caused which promotes the after-swelling of the scrotum and sheath frequently associated with castration.

The testicle having been extruded, the next step in the operation may be carried out in a variety of ways—but it is always advisable to get both testicles out, and cut the muscular or white portion of the spermatic cord before proceeding.

(1) *Searing.*—In the old days, before the use of antiseptics became the vogue, searing was the almost universal practice, and it is still as safe and satisfactory as any other method. It has been superseded, not on account of its non-success, but because the carrying of the necessary searing irons and clams, and the necessity of a fire, made it somewhat cumbersome, and perhaps also because the new chum at the game is apt to favor, for effect, something "flash" or uncommon in the way of instruments. That success attends new methods of castrating is not due to their superiority, but to the simplicity and safety of the operation by whatever method performed.

In removal by searing, the spermatic cord is gripped about an inch from its junction with the testicle (at the *epidydimus*) by a pair of steel or wooden castrating clams, and the searing iron is then applied at a dull

red heat until the cord is severed. Sometimes, in the case of animals in vigorous condition with a full artery, a silk ligature may be put on the artery before it is seared. On severance, the hot iron is applied to the arterial portion of the cord until a good brown sear or seal is made, then the clams are loosened, and the seared end of the cord allowed to gently slip back, that is, if no bleeding from the sear is noticed. If a jet of blood is seen, the clams should be quickly closed, and the searing repeated until an effective seal is obtained.

(2) *Caustic Clams.*—This is also an old method—successful also, but inconvenient in that it necessitates a second visit for the removal of the clams on the following day. The clams are of wood and contain grooves on their opposing surfaces, which are filled with arsenic paste or other caustic. They are applied tightly, and fixed one to each cord just above the testicle, which is then cut away. The clams are allowed to remain on for 24 hours, during which time the caustic has effectually destroyed and blocked the artery.

(3) *Torsion.*—In addition to the steel clams, a special pair of forceps is used for castration by torsion. These forceps are a kind of glorified pair of pincers, with flattened and roughened claws, with which the cord is grasped and twisted until it is severed. By this means, the coats of the artery are stretched or torn asunder. and by their elasticity they curl in and efficiently block the torn end of the artery so that a clot is quickly formed and bleeding arrested. It should be observed that there is no bleeding from the end of the cord before allowing it to slip back on loosening the clams.

(4) *The Ecraseur* (French for "crusher.")—This is an instrument provied with a slot through which the loop of a chain, constructed like a bicycle chain, passes. The chain loop is passed over the testicle on to the cord, and is gradually tightened by the action of a screw handle, so that the cord is compressed and ultimately severed by being torn through. The artery becomes sealed in the process, as when it is severed by torsion, and there is little bleeding from it; but the process is somewhat slow, and on that account mainly has not come into that general use which its safety and neatness warrants.

(5) *Castrating Forceps (various).*—Many kinds of castrating instruments have been invented from time to time. They are mostly of two types, of which the "Reliance Castrator" and "Kendall's Emasculator" may be taken as examples.

The "Reliance Castrator" has a scissors-like action; one leg of the scissors is curved, and has a double blade, forming a slot, into which the other blade (single) fits, on the instrument being closed. Both blades have serrated edges, and when the cord is placed between them, and their closure commenced, the tissues (including the artery) are forced by the single blade into the slot between the blades of the double leg, and severance is brought about by compression within the slot and by the scissors-like action of the serrated edges. Slowness is required in manipulation, otherwise the artery is more likely to be cut than torn through, and the sealing is then not effective.

The "Emasculator," invented by Mr. W. T. Kendall, M.R.C.V.S., Principal of the Melbourne Veterinary College, is an instrument designed to simulate the action of the teeth in biting, and it is perhaps the safest and most practical castration instrument that has yet been introduced. It resembles a farrier's pincers, with the face of the claws broadened to about

3 inches; one claw has two blades, forming a slot, about an inch deep, and into which the single blade of the other claw fits on closure. All the blades have dentated or tooth-like edges, but the special feature is that the single blade first contracts the slot on its under surface, and when it is pushed home on its upper surface. Thus when the cord is compressed by the blades it is dragged into the slot and the tearing or biting pressure is spread over about an inch of the cord. The severance is therefore brought about by an inch-long crushing or laceration of the cord, instead of by a cutting or tearing at one spot. In using this instrument, the cord should be gripped by the claws, which should then be closed firmly and slowly. The testicle may then either be pulled off or cut off at the back of blades, and the crushed end of the cord liberated by opening the blades gently.

On completion of this part of the operation, all blood should be washed off with the antiseptic solution. and the scrotum and inner aspect of the thighs anointed with a dressing of lysol or creolin and linseed oil (1 to 100). This for the double purpose of deterring flies and preventing excoriation of the skin by discharges from the wound during the healing process.

CASTRATION IN THE STANDING POSITION.—In the absence of a trevis, or narrow crush pen, the animal is best fixed for this operation by roping him close alongside a post and rail fence—his off-side to the fence, in such fashion as to prevent him moving outwards. For the safety of the operator, a twitch should be used, and a side line put on to prevent undue freedom of the near hind limb. The operator needs to stand close up to the near hind, pass the left arm in front of the stifle, and grasp the testicles with the left hand from the front, so as to tense the skin. With the knife in the right hand round the back of the thigh, a rapid cut from before backwards is made through the skin lengthways of the testicle—first one and then the other. The knife blade should be held so as to guard the depth of the cut, and if the incisions are made smartly and dexterously the horse will do no more than flinch. Flinching at this time is allowable for the horse, but not for the operator. So effective is the first smart cut in cowering the horse that he seldom gives any trouble afterwards, and some operators, when dealing with colts, never bother to fasten them at all. For the severance of the cord in the standing operation, either the "Ecraseur" or Kendall's "Emasculator" may be used, but the former is perhaps preferable, as it can be easily worked by an assistant from behind while the operator holds the chain loop in position on the cord; or, the caustic clams may be affixed and the testicles removed with the knife.

UNTOWARD RESULTS OF CASTRATION.

HÆMORRHAGE.—Slight hæmorrhage always occurs after the animal rises from the operation, the bleeding being from the vessels of the skin and cord—not necessarily from the spermatic artery. If the flow is from the latter, it will stream down the inside of the limbs, and in such cases it is necessary to insert a full plug of carbolized tow or cotton wool, so as to favour the formation of a clot on the end of the bleeding vessel. The plug may be removed the following day. If plugging fails, the artery will have to be ligatured, and to do this the horse will have to be cast again, and the artery searched for and picked up with a pair of artery forceps.

AFTER-SWELLING.—Except this is excessive, no notice need be taken of it, except to limit the diet and allow the animal to take gentle exercise in a small paddock. In some cases, it will be advisable to make patent the wound openings in the scrotum with the fingers, and so dis-imprison the collected discharges, and it may be necessary to enlarge the openings. If the swelling spreads forward to the chest, and is inconveniently excessive, a puncture or two here and there with a clean blade will allow fluid to drain away, and relieve the swelling considerably.

SEPTIC PERITONITIS, or TETANUS (Lock-jaw), may supervene in from three to fifteen days, when, through the use of unclean instruments, the germs of these diseases have gained access to the wound, but the risk is not great, as the usual bleeding has a salutary effect in flushing the wound free of foreign matter. (For tetanus inoculation during castration, see later articles.)

RUPTURE (Scrotal Hernia) has been previously referred to. On the occurrence of such an accident the only course is to speedily throw the animal, swab the protruding portion of bowel with a non-irritant antiseptic, and push it back as gently as possible. The wound must be securely stitched, and the horse kept in the recumbent position as much as possible. A fatal termination can, however, be scarcely avoided.

CASTRATION OF OTHER ANIMALS.

The same general directions as for castration of horses may be applied to the operation on other animals. In the case of bulls and lambs, the manner of opening the scrotum is sometimes varied. The end or tip of the purse is grasped and stretched, and a piece is cut off bodily by a cross section, so allowing the testicles to be easily extruded. When this is done, the skin of the scrotum curls upwards and inwards, and shrivels considerably during the healing process, and a bullock so gelded never shows or "handles" the same amount of "cod" as one in which the longitudinal incisions have been made.

CASTRATION OF RUPTURED HORSES.

SCROTAL HERNIA—that is, a rupture—in which a portion of the bowel has passed through the abdominal wall at the inguinal ring, and descended into the scrotum, renders castration in the ordinary way impossible; and what is known as the "covered operation" is substituted. This, as originally practised, is a tedious operation, and is the subject of elaborate explanation and direction in text books on operative veterinary surgery. But the method introduced by Williams is far simpler and equally safe. Williams' operation is simply castration with the caustic clams, without opening the scrotum. The bowel is pushed out of the scrotal sac while the animal is on its back, and the scrotum and its contents—the testicles—are included in a pair of strong caustic clams applied tightly above the testicles and as close as possible to the belly. The clams may remain affixed until the testicles and scrotum slough off; or, the testicles may be removed with the knife below the clam the following day, and the clams allowed to remain in position until they drop off. If Möller's plan of cutting through the skin before affixing the clams is followed, great care must be taken that the *tunica vaginalis* (or inner skin covering the testicle) is not incised.

THE ELEMENTS OF ANIMAL PHYSIOLOGY.

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(continued from page 458.)

CHAPTER II.

Mammalian Tissues.

The lowest form of life is, as has been stated, the single-celled plant or animal. The bioplasm of such a cell carries out manifold functions; at its surface food for fuel and repair is absorbed and waste products are excreted; it prepares ferments and chemical antidotes against certain poisons as we shall see later; it is contractile and can propagate the disturbance caused

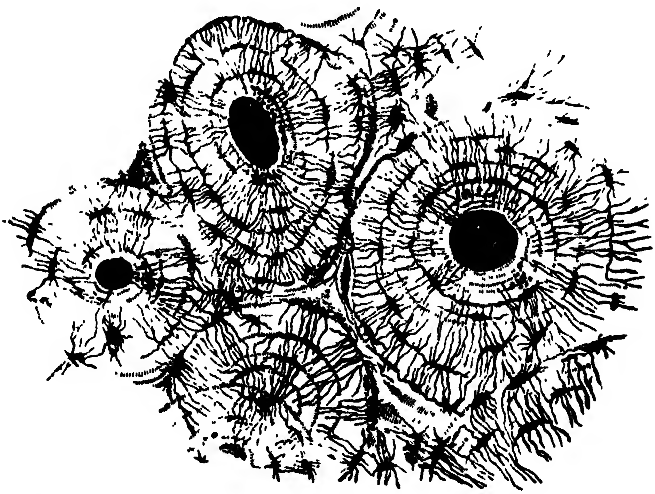


Fig. 10.—Bone showing the tube systems cut across; the bone cells with their prolongations (coloured black) lie between the tubes. The space in the centre of each system contains blood vessels and nerves. (After Sharpey.)

by a stimulus; it can also store food to some slight extent. The animals and plants next in order to these single-celled beings are those which may be looked on as colonies or communities of cells. But in such a colony there is a certain specialization of labour; one set of cells, for instance, may be concerned chiefly with the capture of food, and may allow the other qualities of its units to remain in a backward condition. Another set may have chiefly to do with the locomotion of the entire colony. As we proceed upwards in the scale of life, and especially is this the case with animals, we find that the collections of cells become larger and more differentiated and each set of cells more dependent on all the other sets, so that its units die if cut away from the main mass. When in such a collection of cells we find that the reproductive function is specialized, when from one cell (egg or spore) there can arise not only reproductive cells but cells representing all the various sets present in the complex, then we can no longer regard this complex as a mere community—it has become a single individual.

As we proceed upwards in the evolutionary scale we find then that new groups of cells are marked off from their fellows to carry out some function, and that the other cells of the animal body are relieved of this

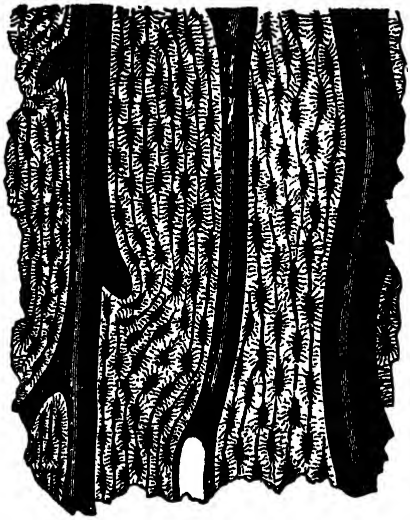


Fig. 11.—Bone showing the tube systems cut longitudinally (After Rollett.)

function. This division of labour makes greater efficiency possible, for the whole time and material present in each cell can be applied to the performance, not of many duties, but of one only or, at least, a few. Thus we

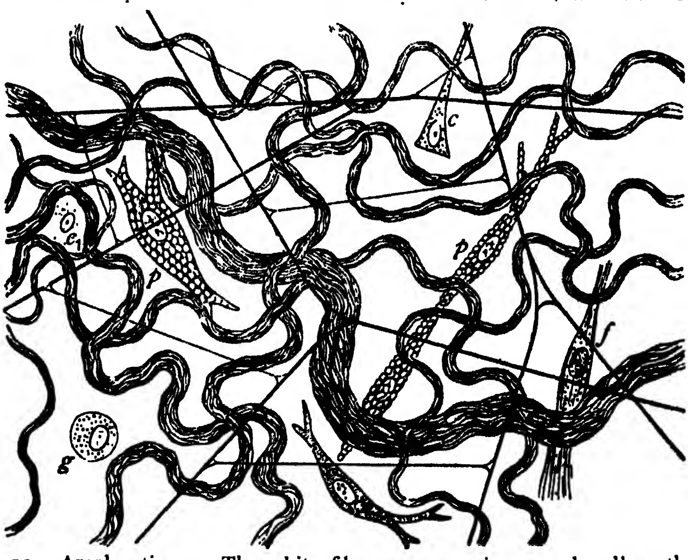


Fig. 12.—Areolar tissue. The white fibres are seen in wavy bundles; the elastic fibres form an open network. (After Schafer.)

find in muscle a number of cells so altered that contractility is the chief or only function which they retain, whilst other powers have been suppressed. Each muscle cell can contract, and contract more forcibly than

any single-celled organism, but only when waste material is removed, when it is shielded from injury, when it is kept at the proper temperature and washed with a solution of the proper concentration and chemical composition—and all by the labour of other cells, which, in their turn, are arranged in groups, each group carrying out some single or simple set of functions, and all of them forfeiting the power of contractility.

Such a division of labour finds a parallel but by no means so perfect in communities of men. The higher the civilization the greater is the specialization of duty, and the more dependent is one group on another. We can see at the present day that the tendency is for men not only to apply themselves to one trade or profession, but to specialize in it, whilst other parts of the same calling are specialized in by other men, and all the time the other necessities of life are being attended to by other groups of

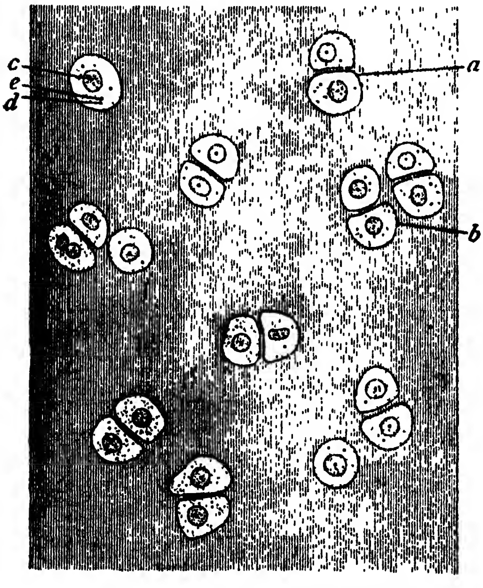


Fig. 13.—Ordinary cartilage. (After Schafer.)

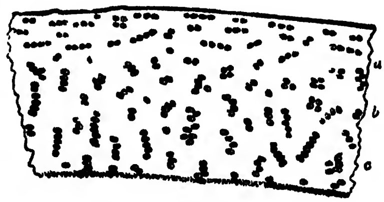


Fig. 14.—Cartilage at the end of bone entering into a joint.

specialists. Now just as this tendency to specialize is regarded as an essential and a proof of advancing civilization among men, the same tendency to specialize amongst cells of the animal body has meant advancing organization of the body or evolution.

Every animal starts life as a single cell (fertilized egg). The cell divides into two, and each daughter cell divides and subdivides repeatedly. Even at an early stage of development the cells display a differentiation into two or three groups. As growth and cell multiplication continue, more and more differentiation is discernible until, in the mature animal, the differentiation reaches its limit for that particular species to which the individual belongs. The structures, therefore, which are found in the animal body may be classified according to the type of cell of which they are composed—in other words, may be classified into TISSUES.

Connective Tissues.

The cells in a particular group, relegated to a particular function, could not act properly unless supported and held in position. Moreover, each group must retain its proper place and not be liable to any great alteration in position or shape. We find then that between cell and cell there is always a cementing substance or INTERCELLULAR SUBSTANCE even when the cells are apparently in close contact. This intercellular substance, though outside the cells, has been derived originally from cells. But such a union is not sufficient for the body's needs, and thus it comes about that certain tissues are set aside to act in a purely physical manner, to support and bind the cells of active tissues together, to hold organs in position, and to give rigidity and elasticity where such is required. Such tissues are connective tissues, and in them we find that the intercellular substance is often in great excess of the cell proper though dependent on the latter, for, if separated from its cell, it undergoes degenerative changes. The cells in connective tissues have no special function to perform, except to nourish and to maintain the physical condition of the tissues; their activities therefore are small.

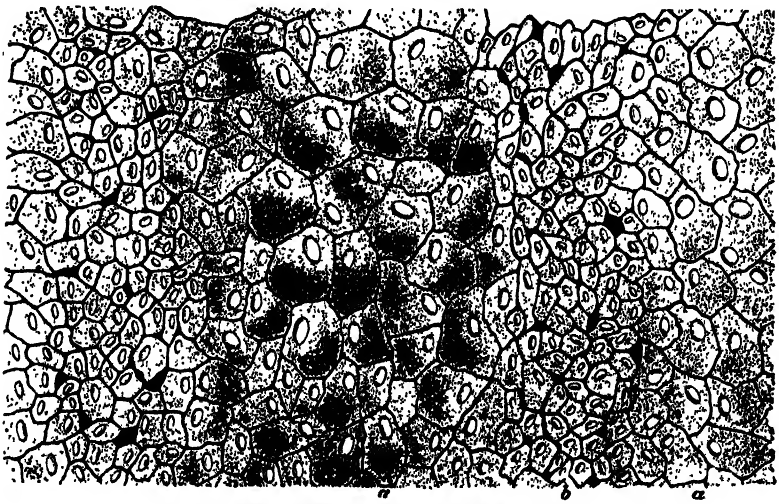


Fig. 15.—Endothelium. (After Klein.)

In FIBROUS TISSUE such as we find in tendon (sinew), the intercellular substance is composed of fine fibres which, though readily bent, are extremely tenacious and almost unstretchable. If the fibres are densely interwoven and spread out to form a flat membrane such a tissue can act as an envelope or tough capsule, as in the eyeball, testis, &c. In BONE we find fibrous sheets, some forming a series of tubes one inside the other, some running from one set of tubes to another, and each bolted to its neighbour by fibrous pegs like layers in the sole of a boot. Even this dense and well riveted tissue is not rigid enough for the body's needs, and so mineral salts, such as calcium and magnesium phosphates, are precipitated through and through the fibrous sheets.

The DENTINE or ivory of teeth is composed of very minute tubes of fibrous tissue which lead from the tooth pulp to the inner side of the enamel, and, like bone, are hardened by deposition of mineral salts.

In ELASTIC TISSUE the fibres have a different chemical constitution which confers on them very different properties—they are highly elastic in the sense that indiarubber is elastic and, in consequence, this tissue is found in parts where frequent stretching is necessary without producing a permanent change. All the larger quadrupeds have a strong band of elastic tissue (*ligamentum nuchae*) running from the head along the back

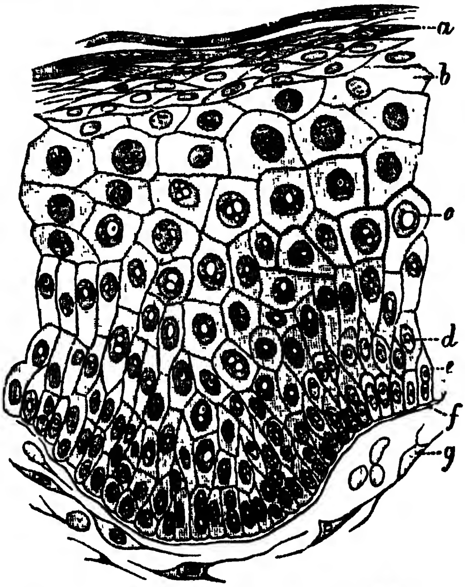


Fig. 16.—Section of skin. (After Cadiat.)

of the neck and firmly joined to the spine. This ligament saves the animal a great amount of muscular exertion by helping to keep the head up or to raise it when lowered. Elastic tissue is also found in the arteries which are subjected to varying pressures of the blood within.

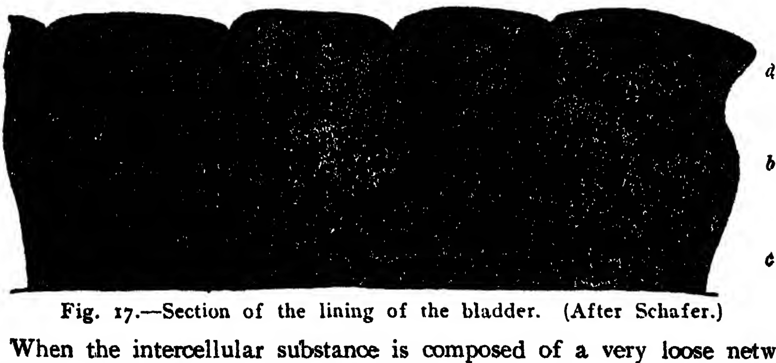


Fig. 17.—Section of the lining of the bladder. (After Schafer.)

When the intercellular substance is composed of a very loose network of fine fibres, some elastic and some fibrous, the tissue is called AREOLAR. Areolar tissue is admirably adapted for holding in its meshes the active cells of other tissues; it enters into every muscle and nerve, supporting the cells and collecting them into bundles. It also enters into every gland, binding the lobes of the gland together.

CARTILAGE, or gristle, is really a form of fibrous tissue, though in some forms the fibres have lost so much of their distinctiveness that the intercellular substance looks transparent and glassy. In a few parts of the body, as in the pads between the bones of the spine, fibres are present, and are elastic. In all forms of cartilage the cells are fairly numerous, and fibres, when they can be seen, have only a short course. Cartilage functions as a pad with a smooth surface on the ends of bones when these take part in forming a joint; it is also of use where some rigidity is required, but where a certain amount of flexibility must also be retained. Thus the ribs are joined to the breast bone by cartilage, the external ear and the nostrils retain their shape by it, and the windpipe is kept open by rings of this tissue.

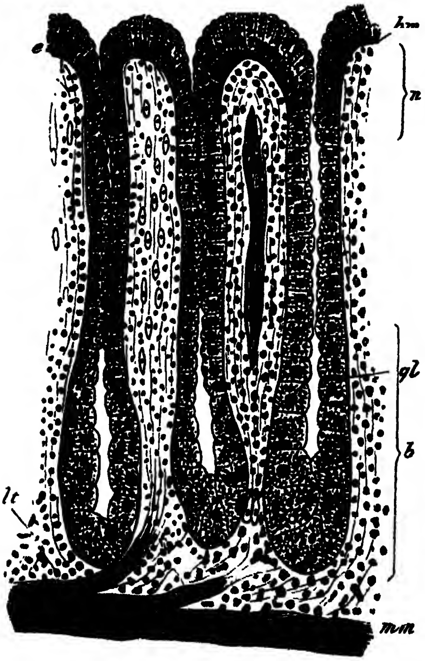


Fig. 18.—Section of mucous membrane of stomach showing simple glands. (After Schäfer.)

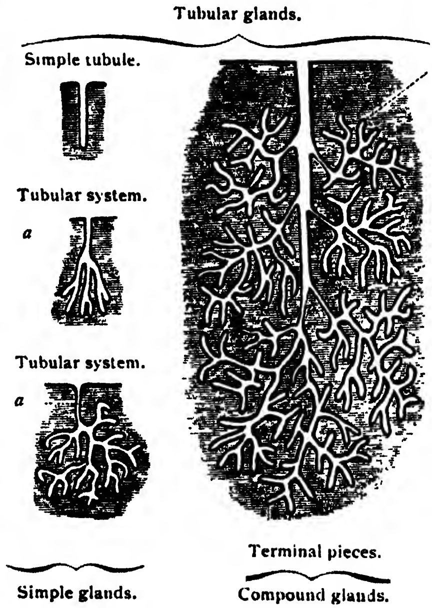


Fig. 19.—Simple and compound tubular glands. (After Stöhr.)

In all connective tissues there are spaces, some like long tubes, but mostly irregular in shape. The spaces are lined by ENDOTHELIUM, which consists of a membrane formed of flat cells one layer deep.

Epithelial Tissues.

Epithelial tissues are composed of cells with well-defined nucleus and a protoplasm that does not branch. The cells are never completely isolated one from another, and as a rule but little connective tissue is found in epithelial structures. In the skin and in the lining membrane of the gullet, tongue, and bladder, epithelium forms a membrane composed of several layers of cells; in the lining membrane or *mucous membrane* of the stomach, gut, and breathing passages it is one cell deep, each cell being joined to its neighbours by a small amount of cementing substance.

All glands which form a secretion and discharge this secretion by a duct are formed of epithelium. To understand the structure of a gland it is necessary to know that when epithelium is not merely protective, as it is in the bladder and the skin, it is either *absorbing* materials, as in parts of the food canal, or is *secreting*, that is to say, is manufacturing

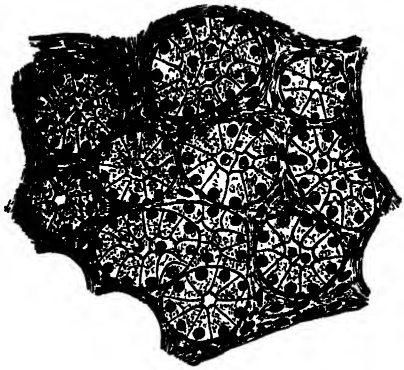


Fig. 20.—Typical section through gland. (After Harris.)

some substance out of the nutriment supplied by the blood, and is pushing this substance outside the cell walls into collecting tubes or ducts. Each gland may, in fact, be looked upon as a factory for the production of some special material; the epithelium of a salivary gland, for instance, secretes

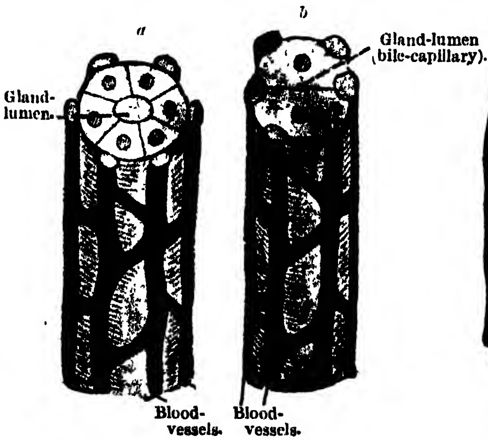


Fig. 21.—(*a*) Scheme of a segment of a terminal piece of an ordinary tubular gland. (*b*) Scheme of a segment of a terminal piece of the liver.

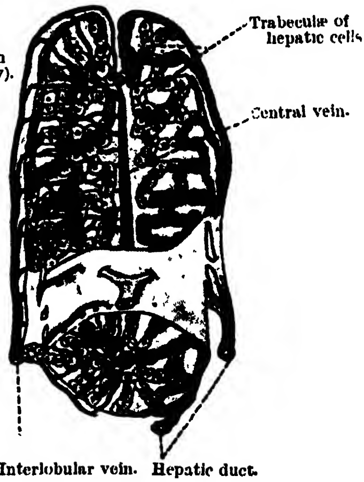


Fig. 22.—Scheme of liver lobule. (After Stöhr.)

saliva, the liver secretes bile, the lachrymal glands secrete tears, &c., &c. It does not follow, therefore, that the functions of all epithelium glands will be the same, even glands which are remarkably alike under the microscope may manufacture totally different substances.

Now, if a secretion has to be poured on a surface which is limited in extent a great increase in the number of active cells can be effected if portions of the surface are dimpled. This dimpled epithelial surface is in reality a gland, and is found as such in the inner wall of the gut and part of the stomach. But this process of dimpling can go much further, and the tube can be coiled as in the sweat glands, or branched as in the testis, or branched and with pockets on the branches as in the salivary and mammary glands and pancreas. A cross section through the tube or pocket gives the characteristic appearance shown in Fig. 20. The liver is in reality a gland of the second variety (branched tube) though here the structure is more complex than with glands generally

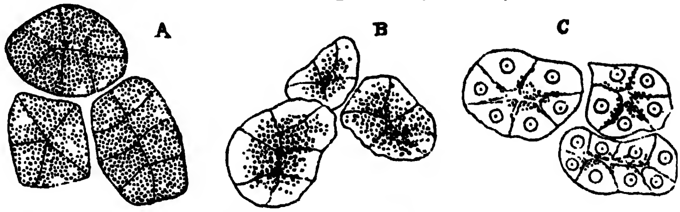


Fig. 23.—Gland cells. (*a*) At rest. (*b*) After a short period of activity. (*c*) After a long period of activity. (After Langley.

The secretions from these glands pass along ducts which are lined by a single layer of epithelium. In all cases the glands can be divided into lobes and the lobes into lobules, which are really terminal branches. Lobules are held to lobules and lobes to lobes by connective tissue.

The progress of secretion in a gland can be followed under the microscope. In a gland which has not secreted for some time the cells can be seen to be filled with granules which represent material ready for a rapid change into the special secretion of the gland; when the gland is stimulated

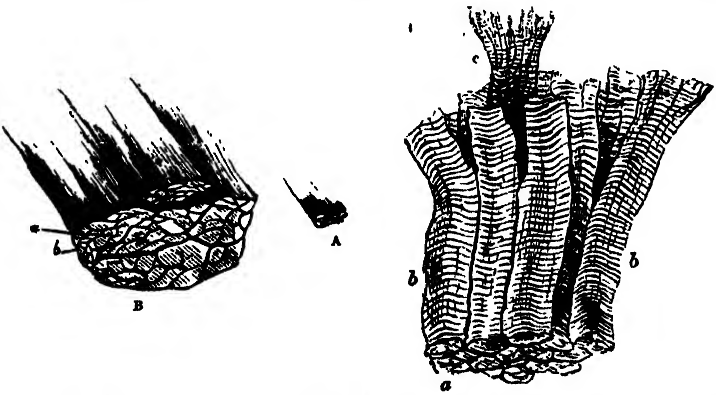


Fig. 24.—(*a*) Small portion of muscle natural size. (*b*) The same magnified five times. (*c*) A few fibres highly magnified. (After Sharpey.)

into activity the granules diminish in number whilst secretion is poured into the space or lumen between the cells. If a gland be stimulated to exhaustion no granules are visible, but on letting the gland rest the granules are built up anew from the nutriment brought by the blood.

Epithelium, when it forms skin, hair, nails, tooth enamel, horn, feathers, scales or transparent parts of the eye, is devoid of blood vessels, but glands composed of this tissue are richly supplied.

Muscular Tissues.

The essential elements in muscular tissue are cells in which the faculty of contractility is carried to a high degree of perfection. There are three types of this tissue from a functional as well as a microscopic stand-point. In the muscles attached to bones and which are under the control of the will, hence called *voluntary* or *skeletal* muscles, the cells are long, thin, unbranched cylinders which show a well marked cross striping, and have each a nucleus placed well to one side. Each cell is enclosed in a thin sheath of connective tissue which insulates one cell from another and helps to form the attachment to sinew or bone. The muscle fibres, formed of the cells and their sheaths, are grouped into bundles by means of connective tissue strands which carry blood vessels, nerves, and a variable amount of fat. A second form is *heart muscle;* here the cells are short and squat, have branches which unite with neighbouring branches, and have their nuclei in the centre. Like skeletal muscle cells they show a well marked cross-striping. A third form is *smooth* or *involuntary* muscle which is concerned with the movements of those organs such as the stomach, gut, bladder, uterus, &c., which are not under the control of the will. The

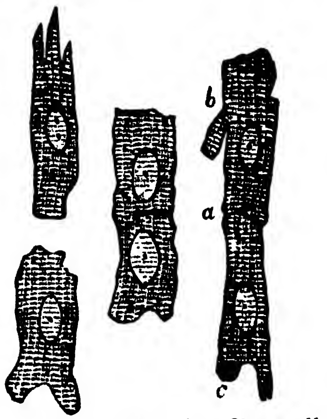


Fig. 25.—Muscular fibre cells from the heart. (After Schäfer.)

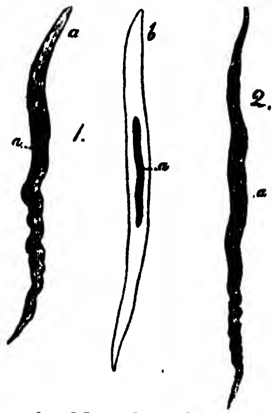


Fig. 26.—Muscular fibre cells from the muscular coat of the small intestines—"smooth muscle." (After Schäfer.)

cells here are short in length and taper at both ends. The nucleus is in the middle, and is elongated in shape. In both heart muscle and smooth muscle connective tissue carrying nerves, blood vessels, and fat is present, but it never forms an insulating sheath for the contractile cell.

Lymphoid Tissue.

This tissue, as it is found in the spleen, tonsil, lymph glands, &c., is simply areolar tissue packed with small round cells. The full significance of organs composed of this tissue we are far from understanding, the little that is known will be given in the chapter on blood.

Fat or Adipose Tissue.

With the exception of a connective tissue framework which carries blood vessels and nerves, adipose tissue is composed entirely of cells, in each of which an accumulation of fat has occurred to such an extent that the nucleus, with only a small amount of protoplasm around it, is pushed to one side.

Fat acts as a valuable store of fuel food; it also serves as a padding filling up spaces, and so holding organs in position and shielding them from injury; under the skin it forms a non-conductive layer which prevents the heat of the body from escaping too rapidly.

Fig. 27.—Section of spleen showing lymphoid tissue. (After Schofield.)

Fig. 28.—Fat cells, showing nuclei at the side. (After Klein.)

Other Tissues.

The blood, which is generally reckoned as a tissue, and the structures present in the nervous system, are so specialized and important that a description of them had better be deferred until their functions are dealt with.

THE MELBOURNE ROYAL AGRICULTURAL SHOW, SEPTEMBER, 1906.

A. T. Sharp, Assistant Editor.

The 1906 exhibition of the Royal Agricultural Society, which was held from the 4th to the 8th September, was a very successful one from practically every aspect. The weather conditions were very favorable, and the entries, which numbered over 6,000, constituted a record for any Australian

show. During the year many improvements have been effected at considerable cost by the society, and they tended to greatly increase the comfort of visitors. The stock exhibited were very high class. Thanks to the courtesy of the proprietors of the *Australasian*, a typical illustration is reproduced on the front cover of this journal; the cow shown is the champion Ayrshire, "Ada II. of Glen Elgin," the property of Mr. T. A. Grant, of "Glen Elgin," Toolern. The machinery and farm appliances were numerous and up-to-date, and were closely inspected. The financial result was eminently satisfactory, the profits totalling no less than £5,553.

As usual, the Department of Agriculture was well represented. Its special pavilion was thronged daily by sightseers, who were greatly interested in the exhibits of the various branches. Messrs. Crowe and Knight had the control of the exhibits, and were ably assisted by the other departmental officers.

The Dairy and Export branch had a splendid series of exhibits. First and foremost was that representing the butter industry. Some interesting figures which surrounded the exhibits struck the eye of each visitor. Since the inception of the export trade in 1888, Victoria's exports of butter have totalled £16,936,690. Whilst every one is pleased that such an extensive trade has been built up, it is also encouraging to know that it is capable of being largely developed. In 1905 Great Britain imported butter to the value of £21,585,632, of which we sent £1,736,789. We have therefore nothing to fear from over-production when this and many other markets are open to us. In addition to the butter, there was also an attractive exhibit of cheese of many kinds and sizes. Further on, milk in various forms—condensed, concentrated, sterilized, humanized, dried, &c.—was effectively shown. The meat export trade was well to the fore. Carcasses of mutton, lamb, and pork were on view, and proved a valuable object-lesson to many. For the sake of comparison, unsuitable carcasses were also hung, and showed clearly what should be avoided. In close proximity to the carcasses there was a fine display of tinned mutton, beef, and rabbit—roast, boiled, spiced, corned, lunch, &c. As in former years, poultry and eggs were special features. This department was under the superintendence of Mr. Hart, who also gave daily demonstrations of poultry dressing.

The exhibit of the Field Branch attracted a good deal of attention. Mr. Lee, Agricultural Superintendent, had a unique collection of soil cores, illustrating some of the different types of soil prevailing in Victoria. The cores, of which there were 50 on view, clearly showed the relative depths at which the changes in colour occur. The collection was quite original, and one calculated to arouse the interest of the public, and at the same time form the basis of an important development of soil investigation. Upwards of 100 other cores have also been secured, but owing to limited space they could not be shown. The mechanical analyses of several of the samples were also on view. The arrangement was very good, and the whole decidedly educational. Mr. Lee also had a nice collection of wheat, oats, and barley, grown last season on the various experimental plots.

Mr. J. Knight, of the Rural Industries Branch, had quite a varied collection under his control. Prominence was given to flax cultivation; the products of both the Linum and Phormium varieties were shown in all stages. Mr. Knight obtained a large amount of valuable information regarding the latter when he visited New Zealand recently, and was

therefore besieged with inquiries. Samples of the maize and cow pea seeds recently imported by the Department, and an effective exhibit of preserved and dried fruits, were on view. Throughout the show interesting demonstrations of fruit grading and preserving were given. A new method of preserving fresh fruit was brought prominently under notice by the exhibition of several cases of apples (Jonathan, Yates, Munro's Favorite, and others) and pears (Harrington's) which had been picked for upwards of 22 weeks, and were still in good condition. Certainly if the discoverer can obtain equally successful results with large quantities, the fruit trade will be revolutionized.

The Vegetable Pathologist (Mr. D. McAlpine) exhibited a large number of specimens and plates, illustrating the fungus diseases which affect cereals and fruit trees. An extensive collection of grasses was also staged.

The Entomological Branch was well represented, and Mr. French's collection of birds, insects, &c., was greatly admired. In these days, when

EXHIBIT OF FIELD BRANCH, SHOWING SOIL CORES.

nature study is receiving so much attention, it is not surprising that the fine lot of life histories of noxious and beneficial insects was closely inspected. Over 100 additional life histories were exhibited this year.

For the first time since the pavilion was erected, the Botanist's Branch was represented. The exhibit, although rather unpretentious, was nevertheless educational. The principal feature was the collection of "proclaimed plants" of Victoria, which are being dealt with in the *Journal*.

Advantage was taken by Mr. Kenyon, Engineer for Agriculture, to bring the benefits of the silo under the notice of visiting farmers. A partially built silo was erected outside the pavilion, and Mr. Kenyon was kept busy supplying necessary particulars to intending builders.

Mr. Seymour (Potato Expert) and Mr. Temple Smith (Tobacco Expert) had interesting exhibits, and dispensed a large amount of valuable information to growers. Every year brings an increase in the number of varieties of seed potatoes, and growers are naturally anxious to obtain the opinion of the departmental expert as to their value. The tobacco industry in Victoria is decidedly on the up-grade. Double the area is under cultivation, many growers are adopting up-to-date methods, a number of the best varieties have been established in the different districts suitable for their cultivation, and the market is improving.

The Publication Branch had a good stand, and the wall space was utilized to the fullest advantage in bringing the various publications of the Department under the notice of the producers, in whose interest they have been issued. The officer in charge, Mr. Kemp, distributed specimen

FIBRE EXHIBIT.

copies of the *Journal* to visitors. Mr. Bramwell, of the Closer Settlement Branch of the Lands Department, was also in attendance, and supplied suitable literature to inquirers.

The annexe allotted to the Agricultural Colleges was fully availed of. The majority of the exhibits were from Dookie College, but Longerenong College, which was recently reopened, also contributed some, which clearly showed that good work had already been done under the superintendence of the principal, Mr. Sinclair. "How Wheats are Made" was brought under prominent notice by Mr. Pye, principal of Dookie College, who has achieved considerable success as a hybridist.

FOURTH CONVENTION OF THE VICTORIAN CHAMBER OF AGRICULTURE, JULY, 1906.

(*Continued from page* 555.)

IX.—THE FRUIT INDUSTRY OF VICTORIA.

C. Bogue Luffmann, Principal, School of Horticulture and Small Farming, Burnley.

As I am constantly engaged in the training of fruit-growers and in the management of orchards, I will endeavour to explain the position and wants of the fruit-growing industry. From a fruit-growing stand-point, the position, climate, and natural resources of Victoria render her the most favoured of the southern States of the Commonwealth. Transit facilities are also the most expeditious. The local market for fruit is the greatest, and the first and general cost of orchard work is less than in any State except Tasmania. The natural rivals of Victoria outside the Commonwealth are few—Cape Colony and New Zealand alone having the same season and choice of fruits, such as are desired in the European markets. (Of such fruits as can be preserved, Victoria has many rivals, but, at the same time, advantages in season which enable her to maintain profitable trade.)

Victoria is the most self-contained of the Australian States, since she produces all the fruits she requires, excepting those of a purely tropical character. She also exports largely fresh fruits, dried fruits, and sweet preserves. No other State has a fruit trade of such magnitude, nor exports to so many markets. It is, therefore, my desire to place before you some important facts, and to enlist your sympathy in such ways as will give greater value to our fruit industry.

In the first place, we may ask which are the biggest questions for the growers, the State, and the business section of the community? I would direct your attention to the following points:—

1. The position and deficiencies of existing fruit-growers.
2. The functions, achievements, and aims of the State as an educational and guiding force.
3. The business side of the fruit industry.

The grower asks for general instruction and advice. It would be a mistake to overlook this fact. There is not a single branch or detail of the fruit industry of which many engaged in it are not hopelessly ignorant. Thus, one man, understanding and having good soil, knows nothing about trees or marketing. Another ignores draining or manuring or pests. A third cannot estimate the influence of climate, or make any intelligent and safe move. Many have irrigation water, and few know how and when to use it. Hundreds of men have chosen bad sites or unsuitable kinds for the climate, soil, and position they occupy; and thus we find in every district a great deal of discontent and a strong desire for instruction in the various branches of fruit-growing. Then the purely business side asserts itself, and I venture the statement that it is rare indeed that a good fruit-grower is also a good business man. The genuine lover of orcharding is shy of the world and its ways. Hence he has serious difficulties in selling his wares.

Let us not forget that the faculty for management is rare; that of every hundred men pitch-forked into fruit-growing—and they were pitch-forked into it some twenty years ago—not ten have such an all-round grip of themselves and their work as to warrant its being a satisfying and home-making venture.

Therefore, as I have said, the orchardist asks for general instruction. From the State he asks for *every* kind of assistance, but, of course, this is impossible, as no Government can endow a man with business habits, greater industry, a broader outlook, or that kind of intelligence necessary to successful orchard work. Shortly, I will tell you what the State can do, and then what the business world can do, to improve the conditions of the fruit-grower, and to give increase of value and permanence to the industry. But before I proceed to this let me say frankly that it is not given to every man who tries it to succeed by cultivating fruit. The orchard is no asylum for the fool or the idler; nor does it follow that sound intelligence cannot go wrong. If the natural aptitude for the work is not there, it matters not what may be. Summarized, as a people—

1. We lack order.
2. Work is intermittent where it should be constant.
3. The lack of self-control is all too frequent.
4. Money is the only thing sought, where a home is the most needful.
5. The disposition to make "a rise" and move on is painfully common, and amid all, the waste is awful.
6. Most orchardists fail to keep soil-making animals.

Admitting that all the above are ugly leak-holes and drains upon any estate, it will not be difficult to account for failure and discontent.

Instead of expecting anything to supplant work, the average grower must make up his mind to do more. He must both make and maintain his soil. He must not exploit and exhaust, but develop and enrich his land. He must stay at home, and feel at home. He must help to secure a reputation for his district rather than for his own bit of produce. He must keep such heavy animals as cows and pigs. I have been saying this for years, and, happily, it is now beginning to dawn on the fruit-grower that it is right. Every fruit-grower should keep cows and pigs in proportion to the amount of manure his soil and trees need. Of course, if he intends to remain a fruit-grower he will regard the animals as the merest by-products -soil-making factors. It is only near to towns and large natural manure supplies that animals may be disregarded. Such districts as Doncaster will always be independent of animals; whereas they should exist by thousands in all regions remote from towns. Now, I am aware that before we can induce the fruit-grower to do this we must teach him a great deal, and possibly eliminate a good many from the present list.

We must teach him in the aggregate, and, as far as possible, in the particular, a great deal that he does not know about soil and trees, sorts and seasons, markets and methods, and place before him as many profitable examples as we can in the way of well-managed and paying estates. Another serious—almost incalculable—loss has occurred through lack of concentration. Small men suffer from isolation; and every line of fruit would yield more in the aggregate if it were grown in fewer districts. It is rare indeed that the commercial fruit-grower succeeds best by having many sorts. And this applies to the growers of any one place. The

more unanimous they are in their choice the more likely they are to build up and maintain a safe market. We want certain districts to achieve reputations for certain fruits; and, further, we want to discourage planting in many quarters. Victoria has, roughly, four climatic zones, and these place our commercial fruits in four more or less distinct groups—North-west, north-central, high-central, and south coast.

Tasmania and Mildura are the two favorable examples of the value of concentration and unity of aim In both instances the growers have been compelled to adopt the same methods, and employ the same means of transit and marketing. The results forbid any argument. Now, the State is doing its part by—

1. Providing a School of Instruction, and complete orchards and accessories at Burnley.
2. By instruction through the medium of the *Journal*, and special reports.
3. By meeting every inquiry by post or in person.
4. By giving lessons in general orchard work throughout the State.
5. By having inspectors to advise about diseases and pests, and secure their eradication.
6. By six demonstration orchards, in as many zones, where special groups of fruit are chosen, and soils and men selected most capable of showing what can and should be done to secure a permanent return.

Now, I presume that a body of this importance is desirous of aiding every industry which it selects for discussion, and that being so, I would warn you against the danger of pushing the higher education of the agriculturist too far—that is, the training of those who are expected to become actual producers. Curious and hair-splitting students will be of no value in the field. I speak with some experience, and as much sincerity, on this subject. If we are to fit men for the land we must teach them by and on the land. A little theory and a great deal of solid practice is wanted. P. G. Hamerton—one of the sanest of writers on this subject, says—"No acquirement really becomes our own until we make constant use of it for ourselves. Educational experiments may provide the instrument, but they cannot insure its use." M. Rister, Director of the Institut Agronomique in Paris, declares — "Ordinary farm work cannot be successfully combined with scientific teaching. If you pursue both practice and theory, you will make bad practical men and bad scientific men. Our pupils require all their life for becoming practical men." Now, I know this to be absolutely true. I have had the training of hundreds of regular students, and I have met and advised thousands of men in all parts of the State, as well as in other countries, and I have always found that the studious student would make no fruit-grower—he was impatient of following the plough, or doing such a common-place job as packing apples. I must speak of these things because man is a part of our scheme, and if we fail to recognise the ordinary disposition of human nature, we shall make no improvement in this fruit industry.

I cannot refrain from saying a word in favour of the jam factories. Not so long ago the average grower disliked these exceedingly. Now they are recognised as a great boon. As a matter of fact, they have been the salvation of some branches of the fruit industry. And, as this is the result of intelligent organization, may we not hope to have merchant growers, just as we find in France, Spain, Italy, the Levant and America?

I know that it is almost dangerous to talk about servants and masters at this time of day, but there is no doubt that we have thousands of men on the land who, unable to manage entirely for themselves, would be infinitely better off if working as part of a large organization. I know that there are many difficulties in the way, as all the failures are not side by side or representing one industry. But, apart from any absorption of the existing small estates by large firms, the merchant producer, with his fruit farm, could help the industry amazingly. I have been trying for years to bring him into existence, and I must confess that so far I have been unsuccessful.

We need a large orchardist in every important district, equipped with the means of giving a thorough field experience to students who pass with credit through such institutions as Burnley, Rutherglen, and Dookie. It is impossible to teach business habits and general estate management in a school. The Principal manages, therefore all others are relieved of responsibility. There can be no wisdom in training boys with small or no capital on big estates. It is cruel! They may be schooled in large institutions, but their practical training must be on areas similar to what they are capable of owning or managing. This applies to agricultural training in all its forms, and it is a very remarkable fact that it has so far been completely ignored throughout the length and breadth of Australia.

It is for those depending on, and believing in, the fruit industry to improve matters by providing the field training. *Small men* have not the accommodation for students; hence the State may here and there assist. Failing any reliable instructor and leader in the country, the student must needs go amongst men less orderly and less informed than himself. He knows what is right, but lacks the power, through want of experience, of putting it into practice. Moreover, he may be an excellent man, yet entirely without capital. He cannot start as a manager, since he has too little experience, and large estates are too few and irregular. Now, what we can, and should do is to equip places in the country for the reception of our youths. Various ways are possible in the form of awards to the owners of these estates. Each needs a skilled manager, who might for a time at least be paid from three sources—the owner of the estate, the Government, and the district association. The four distinct training grounds wanted are:—

1. The State Institutions.
2. The merchant producer.
3. The State-aided fruit farmer (Department of Agriculture).
4. The large private grower, giving instruction in the field.

The industry would soon increase and improve in every way. All the above should be able to supply one or more fields. Consider the advantage of, say, only six such training grounds, taking two or three young men each year. In a very short time, we should have men seized of the necessities of every part of the State. Those places which are dragging and failing would be turned to shape and use, and a safe balance struck between purely scientific and practical field work.

I incline more and more to the belief that our teaching must be regional for, when all is said and done, you cannot apply any agricultural rule over a very big piece of country. Our University, public and State institutions, can give the ground work, but when it comes to obtaining experience, that must be sought where it is intended to apply it when gained. Hence, if we could have a fruit farmer working on thoroughly business lines, such an one would set up a standard for the whole district;

he would be a safe man to instruct others, and there would be no danger of youths desirous of becoming masters of the craft failing for lack of opportunity. I would have one of these in every district. I know that it would be difficult to find really good men and estates, but the difficulties are not insurmountable, and we shall have more serious ones unless we do something of the kind.

Now, if we adopt some such scheme as this, we can look into the future with some hope. We know the country better—its favorable and unfavorable areas. We can defend ourselves against booms and the boomer class. Of markets, we are well acquainted, and we know what is wanted, and what pays best. Enormous areas favorable to the growth of the best class of apples and pears, as well as the small preserving fruits, are to be found in the southern and central districts. The western district, and the drier parts of Gippsland, will yield the export fruit farms of the future. We must never forget that our only hope is in the young. If we will take a thoroughly disinterested view of our position and resources, and provide safe stepping-stones for those who would live by the land, the fruit industry can be made of great value in our industrial and social life.

X.—TELEPHONE LINES IN COUNTRY DISTRICTS.

John Hesketh, Chief Electrical Engineer, Postmaster-General's Department, Central Staff, Melbourne.

The intention of this paper is to describe briefly the different classes of telephone lines in country districts, the conditions under which they may be erected; and the best methods of erecting and maintaining such lines. It is just as well at the outset to consider how many different classes of country district telephone lines there are.

First, there are those entirely on the land of the user, such as those connecting a head station with out stations and boundary riders' huts, or connecting a farmer's residence with other buildings on a large holding.

Second, there are telephone lines which extend beyond the land of one individual to connect with a second farmer or station, but which lines do not go beyond the private lands of one or more persons.

Third, there are telephone lines which, in addition to being partly on private land, cross, or are erected for part of the distance along, public roads, to connect with the nearest post office, telegraph office, or telephone exchange.

By the *Post and Telegraph Act* 1901, Section 81, telephone lines of the first class may be erected by the user without any reference to the Postmaster-General, provided that the line does not go beyond the land in the occupancy of the user. If, however, the line does cross any public road, or extend into the land of any other owner, and so becomes a line of the second class, then the permission of the Postmaster-General must be obtained before the line is erected. This is necessary so that control of all telegraph lines (which includes telephone lines also), which has been vested in the Postmaster-General, may be conserved. Without some such control no properly co-ordinated system of telephones could be efficiently and economically constructed. The regulations as to such lines are, however, made as liberal as possible, and the licence-fee charged by the Postmaster-General on the portion of wire erected by the user is only 1s. per annum for each holding over which the wire passes.

The third class of line, that used to connect farms or stations with the nearest post office, telegraph office, or telephone exchange, may be constructed partly by the user and partly by the Postmaster-General. Speaking generally, the Postmaster-General reserves the right to construct any telephone line within a town boundary, the user constructing the portion outside the town boundary, or where poles of the Postmaster-General are not available. There are, however, surveyed townships which are not closely settled, in which it may be advisable that the Postmaster-General should grant permission for the users to erect the whole of such lines, even up to the post office. The revised regulations provide for this. But when the country district lines have obtained connexion with any post office, it is quite possible that this particular post office may have no connexion with the general telegraph or telephone system of the Commonwealth, and the question naturally arises, how is such a connexion to be

Fig. 1.—Twist Joint, 400-lb. G.I. Wire.

obtained? In such a case the regulations provide that the telegraph or telephone service will be extended to the post office on one or other of the following terms:—

First, without guarantee: when it is shown that the annual revenue will equal 10 per cent. of the capital cost, plus the cost of operating.

Second, with a guarantee: when the revenue is not estimated to equal at once the amount required as stated in "First," but is estimated to equal this amount within seven years. In this case the guarantee is to be in two parts, first—a cash guarantee equal to the difference between the revenue required and the estimated revenue for two years; and second—a bond or guarantee that for five further years (that is making seven in all) the guarantors will make good any deficiency in the amount necessary to bring the estimated revenue up to the required revenue.

Third, when the persons interested do not wish to give a guarantee, they may construct the line themselves, and receive from the Postmaster-General two-thirds of the earnings of the line for telegraph and telephone messages locally; that is to say, in the two-thirds of the revenue paid to the constructors of the line, or persons nominated as trustees, there would not be included any portion of the cable charges for a telegram to, say, England, but the two-thirds would be two-thirds of the charge for the transmission of the message over the portion of the line erected by the persons interested.

It is difficult to set out in a brief but intelligible form, the charges made by the Department for the various services mentioned, but attached are copies of the regulations which give full details. If these regulations are not understood, or if they do not seem to apply to any particular case, the Department will be only too glad if particulars of any desired line are submitted, so that definite terms may be quoted. It appears to be the impression in parts of Australia that the Post and Telegraph Department will not allow would-be users to erect their own lines, and, further, that the charges imposed by the Department are excessive. The foregoing notes and a study of the regulations will show that the Department does allow people to erect telephone lines for themselves. Indeed it would appear to be impossible for the Department to do otherwise in many country districts. All the Department can do is to reserve the right

to erect lines within settled townships and along some roads, but even in the latter case of lines along country roads permission is given for the users to erect the line where such a line will not interfere with the telegraph lines of the Postmaster-General, or unduly interfere with any other telegraph or telephone lines.

It has been suggested that the charges made by the Postmaster-General for erecting wires in country districts are unreasonably high, but it is to be remembered that the cost of sending men long distances to erect single wires makes it necessary to meet such cost by an apparently high charge. It may be taken as true in 99 per cent. of cases that telephone lines in country districts can be erected more economically by the user than by the Department; for the user knows the country knows where timber can be obtained, the cheapest way of getting it, very often has labour which can be utilized without any increased expenditure, and, further, can adopt a lighter and cheaper method of construction than the Department can, because the user is always on the spot ready to make good any trivial defect, whereas the Department would have to send men considerable distances to effect repairs, and therefore must erect substantial lines which would not be liable to interruption. With this one exception, I consider

FIG. 2.

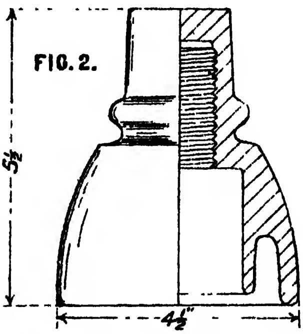


FIG. 3.

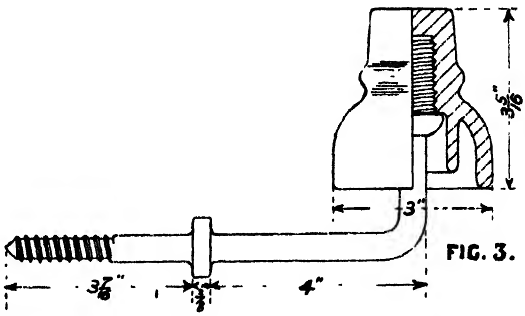


Fig. 2.—No. 5 (Acme) Insulator. Fig. 3.—Bent-stem Insulator and Stem.

that the charges proposed are very reasonable. They are, so far as I am aware, lower than obtain in any other English-speaking community. An example is given later of the charges made in a particular case.

It has been said by some farmers that they do not know anything at all about electricity, and therefore cannot erect a telephone line. To erect a telephone line does not require any more expert knowledge, nor is it any more difficult, than to build a wire fence. Speaking generally, for lines, say, not exceeding 40 miles in length, and having but one or two instruments connected, galvanized iron wire, weighing 200 lbs. to the mile, is quite good enough. For short lines under, say, 10 miles, wire as light as 150, or even 100 lbs. per mile is sufficient. The reason for using galvanized iron wire as against black wire is that it lasts longer, and is, therefore, cheaper in the long run. Steel or copper wire is unnecessary; galvanized iron wire is quite good enough in most instances for short lines. For longer lines, or for those serving several points, heavier wire may be used with advantage, and in some cases the use of copper wire may be justified eventually. The circumstances of each case must determine the kind and size of wire used, but on this point the Department will be glad to give any advice desired. For joining galvanized iron wire the ordinary twist joint (Fig. 1) is quite satisfactory. This joint is improved by being soldered, but many

lines have been in use for many years on which such joints have not been soldered. Figure 7 indicates methods of attaching the wire to the insulators.

A very important point in erecting wire is to take care that it is not stretched too tightly. The influence of temperature on wire is best shown by the statement that in a 50 yards' span of iron wire, at a temperature of 100 degrees Fahr., the sag is 2 feet, while at 30 degrees it is only 6 inches. Now, if the wire had been stretched in summer so that it sagged only 6 inches, when the temperature dropped in winter the wire would snap or stretch so much as to considerably reduce its strength. It is, therefore, advisable to erect wire to a carefully-prepared table of sags. Such a table is given below. If this table does not meet the conditions of users, and the Department is approached, tables for shorter spans and other wires will be supplied.

SAGS FOR IRON WIRE FOR SHORT SPANS.

Factor of Safety of 3 at 30° Fahr.

Temp. Fahr.	Iron. 50 yards.		60 yards.		70 yards.	
°	'	"	'	"	'	"
30		5·9		8 5		11 6
35		8 7		11·4	1	2·7
40		11	1	1·8	1	5·3
45	1	0·6	1	3·8	1	7·5
50	1	2 2	1	5·5	1	9·46
55	1	3 5	1	7·1	1	11·3
60	1	4·8	1	8·7	2	1
65	1	6	1	10	2	2·6
70	1	7 1	1	11 3	2	4·1
75	1	8·2	2	0·6	2	5·5
80	1	9·1	2	1·8	2	6 9
85	1	10·1	2	2·9	2	8·1
90	1	11 06	2	4	2	9 4
95	1	11·9	2	5	2	10 6
100	2	0·8	2	6·01	2	11·7
105	2	1·6	2	7	3	0·9
110	2	2·4	2	7·9	3	1 9
115	2	3·2	2	8·8	3	3
120	2	4	2	9·7	3	4

Insulators.—Insulators may be of various kinds, depending upon the purpose for which they are to be used. Figure 2 shows the large telegraph insulator. It is seldom that such an insulator is required on country lines. Its use would involve the use of an expensive bracket and pin, and is unnecessary. Figures 3 and 4 show smaller sizes of insulators and pins, which would prove quite satisfactory on any line, even up to 50 miles in length. Figure 5 shows an ordinary button insulator, which is quite good enough for securing wires on fences, when the length of line does not exceed, say, 20 miles. On short poles, the insulators (Figs. 3 and 4) may be used with advantage.

The selection of supports for the wire is a matter which must be left in each case to local judgment. If fences with wooden posts are available, they may be used in many cases, or if the fence posts themselves are not used, then saplings or sawn timber secured to the wood fence posts

would suffice. It is to be remembered that the purposes of the support are—(1) To keep the wire out of harm's way—that is to say, from being damaged by cattle, or pedestrian or other traffic, and prevented from doing damage to such traffic or animals; and (2) to keep the wire off the ground, so that the current may not be diverted from its proper path. In the selection of the supports for use on private property, the Department leaves the users the fullest liberty, but with the liberty the responsibility is also given to the users, who must, of course, obtain the consent of owners of other private lands over which they wish to erect a line.

When, however, such a line is erected across a public road, the conditions of the *Post and Telegraph Act* must be complied with. That is to say, the wire must be secured to substantial supports, and must be at least 18 feet above the surface of the roadway at all crossings. When wire is erected along the side of a roadway, it is advisable that it be erected just inside the fence on the adjoining properties, so that shorter poles might be used.

In the selection of a telephone instrument, a certain amount of technical knowledge is required, but the Postmaster-General places the knowledge of his officers on such technical points at the disposal of any telephone user. Not only so, but the Department is prepared to sell to any user the

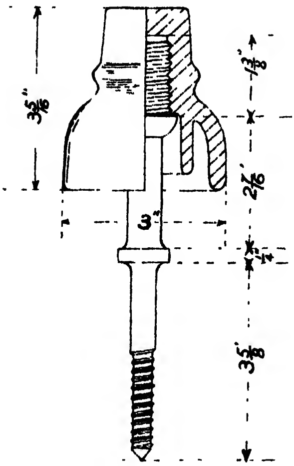


Fig. 4.—Straight-stem Insulator and Stem.

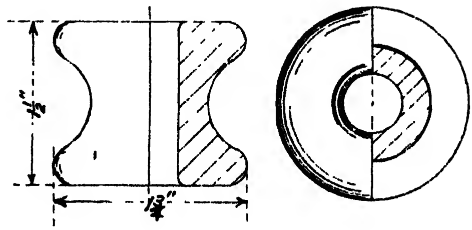


Fig. 5.—Button Insulator.

material and instruments necessary to erect a line to connect with any post office, telegraph office, or telephone exchange, at prices shown approximately in the following list:—

APPROXIMATE PRICE LIST.

Telephone Material for Use on Country District Lines.

Wire, galvanized iron (weighing 400 lbs. per mile), £14 0s. 7d. per ton
Wire, galvanized iron (weighing 200 lbs. per mile), £14 13s. 5d. per ton.
Insulators, large P.O. pattern (Fig. 2), 5¾d. each.
Insulators, small button pattern (Fig. 5), 1d. each.
Insulators, small, with bent stem (Fig. 3), 7d. each.
Insulators, small, with straight stem (Fig. 4), 6½d. each.
Insulators, small, without pins (Fig. 3 or 4), 2¾d. each.
Telephone wall sets, complete, Ericsson pattern (batteries included), £3 18s. 10d. each.

NOTE.—All the above prices are subject to variation at any time, and are for the items delivered at the Department's Stores, Melbourne; packing, &c., extra.

Any one wishing to buy a telephone instrument may be satisfied to accept those which will comply with the Postmaster-General's Department's specification for "branching system" telephones. A "series" telephone should not be accepted. This latter kind of instrument will work very well when only one instrument is to be used on one wire, but when more than one instrument is to be connected on one wire, the instruments should be what is known as the "branching system" pattern.

The use of one instrument only on one wire is most uneconomical. In America, where country district telephones have been more widely availed of than in any other country in the world, as many as twenty telephones are connected to one pair of wires. It is admitted that such an arrangement is not secret, but if secrecy on a country district line is to be attained, it must be at a cost which, in my opinion, is out of all proportion to the benefits. Secrecy can only be obtained by having metallic circuits, and connecting only one instrument on each such circuit, and even then something will go wrong with the wire just when the secrecy is most desired, and the secrecy will fail. It must, however, be clearly understood that a metallic circuit, that is, two wires, gives a better service than a

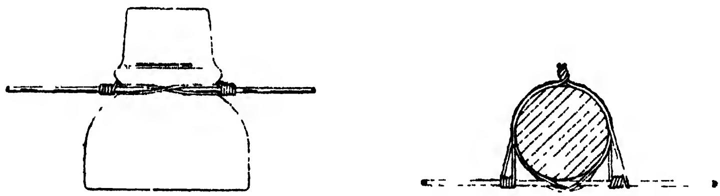


Fig. 6.—Method of Binding Wire to Straight-stem Insulator

single wire. If more than four instruments are to be connected to any circuit, then a single wire will be found objectionable, and a metallic circuit much preferable. It is far more difficult to preserve secrecy on long country district lines than on those in cities. It is far better to assume that you will not have a secret system, and if you must transact confidential business over the telephone, arrange to do it by means of codes.

As showing the effect of the use of telephone lines by more than one person on the rates now offering for country district lines, the following figures are interesting:—

Under the new regulations, the Postmaster-General will erect a mile of wire to the boundary of a town, and give exchange service up to 760 calls per annum for £4 a year for one user. This user erects the line beyond the town boundary to connect with that portion provided by the Postmaster-General, and provides the instrument at the user's end. Should other farmers connect to the same line, the charge is increased by £2 for each additional user, so that five users would pay a total of £12, or £2 8s. each (in addition to the licence-fee of 1s. or 2s. per annum, as the case may be), and for this payment they would *each* be entitled to the following privileges:—

760 calls yearly (380 half-yearly) on the exchange locally, free.
Additional calls, ½d. each.
Transmission and receipt of telegrams over the telephone line, free of extra charge for telephoning.
Sending local telegrams for 3d. each.
Local conversations with non-subscribers, 3d. each.
Conversations with other people *on the same wire*, free.

One important part of single-wire circuits (if not the most important) is the connexion to the earth. It is to be remembered that the telephone current must have a complete path or circuit provided for it. The current may travel outwards by the wire, and return by the earth, or if two wires are provided, may travel outwards by one and back by the other. When only one wire is used there must be a good earth connexion at each end. Many defects on telephone services are caused by defective earth connexions. The best earth connexions are those which connect to the pipes of a water-supply system, but the pipes must be laid underground for a considerable distance, and the joint between the wire and the pipe very carefully made. If no water-pipe is available, a plate of galvanized iron, from $\frac{1}{8}$ to $\frac{1}{4}$ inch thick and 3 feet square, should be buried in loose, damp soil in a hole 5 feet deep, a stout wire (say, No. 8 S.W.G.), or two finer wires, being firmly soldered to the plate. Great care should be taken in securing the wire to the plate. If a plate of iron is not available, then a coil, 3 feet in diameter, and consisting of 20 turns, of No. 8 wire may be used instead; or a piece of 2-in. galvanized iron piping may be driven 6 feet into the ground and the wire connected to the top. All connexions to earth plates should be soldered. The earth in which the plate is buried should be as damp as can be found. Do not bury the earth plate in rocky or dry ground. If necessary, go some distance away to find more suitable

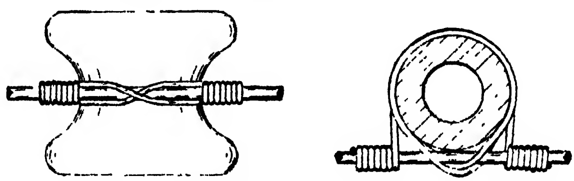


Fig. 7.—Method of Binding Wire to Button Insulator.

earth. The bank of the nearest water-hole will do very well as a site for sinking the earth plate. Take great care that the wire leading from the earth plate to the instrument does not get broken or corroded, especially about the ground level.

Procedure.—If a telephone line in a country district is desired, the best procedure is to at once write to the Deputy Postmaster-General, stating clearly what is required, and ask for full information as to conditions and terms. If any technical information is required, the same course should be followed. For any further general or technical information the Department places itself unreservedly at the disposal of persons desiring to erect such wires to connect with its telegraph or telephone system.

REGULATIONS.

PART X.—TELEPHONE LINES CONNECTING WITH TRUNK LINE SWITCHBOARDS, OR TELEGRAPH OFFICES ONLY.

71. Telephone lines connecting a subscriber with a telephone trunk line switchboard only, and not available for any purpose other than conversations over trunk lines, for which conversations the rates specified in Regulation 47 are to be paid, or telephone lines connecting a subscriber with a telegraph office for use only in connexion with the transmission of telegrams at the prescribed rates, will be provided on payment of the following rates annually in advance, and subject to the same general conditions as lines to telephone exchanges, Part I.—

For a line not exceeding one mile radially from the trunk line switchboard, together with one instrument and the necessary connexion to the trunk line switchboard	£3
For each additional half-mile of line or fraction thereof ...	£1

PART XI.—TELEPHONE LINES IN COUNTRY DISTRICTS NOT ERECTED, OR ONLY PARTLY ERECTED, BY THE POSTMASTER-GENERAL.

72. The Postmaster-General reserves the right to erect all private lines within the boundaries of any railway line, municipality, township, or village, or along any public road.

73. (1) Any person wishing to erect a private telephone line passing beyond the boundary of his own land must make application for permission to the Deputy Postmaster-General.

(2) With the application must be forwarded (*a*) a plan showing the route to be followed, especially marking where roads are to be crossed or entered upon, and the places to be connected; and (*b*) a description of the proposed method of constructing that portion of the line which is not upon private land.

(3) Where the line is erected upon private land the method of construction shall be at the option of the persons constructing the line, subject to the approval, in writing, of the owners of the land, the onus of obtaining which approval shall lie upon the persons constructing the line.

(4) Where the line is erected upon public land of the Commonwealth or of a State, or on or across a road, railway, track, or other place used for traffic or accessible to the public, the method of construction and the poles and other material to be used shall be subject to the approval of the Deputy Postmaster-General, but the approval shall not be unreasonably withheld.

(5) The Deputy Postmaster-General may direct an officer of the Department to examine the application and the accompanying particulars, and, if necessary, make an inspection of the route.

(6) The cost of such inspection shall be borne by the person wishing to erect the line.

(7) Should the report of such officer disclose that the line will not in any way interfere with or endanger any other line of telegraph, whether belonging to the Postmaster-General, the Railway authorities, or any private person, and that the material and method of erection to be adopted for the construction of that portion of the line which is not upon private property are satisfactory, the Postmaster-General may, upon payment of the prescribed fees, grant permission to erect such line.

(8) Provided, however, that such permission shall in no case be granted where a line is to run from a point in the vicinity of a telegraph office to another point in a like vicinity unless the line is to connect to or through a telegraph office.

74. Permission shall not be granted for any such line to be erected along any public road, railway, or track, unless the Deputy Postmaster-General is satisfied that it is in every respect unobjectionable, and that the consents of the Railway and local authorities, where necessary, have been obtained.

75. Permission will not be given to erect private telephone lines along a public road, railway, or track where poles of the Postmaster-General are already available for those lines.

76. If the line crosses a road, track, or other public place, the height of the wire above the highest portion of the road, track, or public place, shall not be less than 18 feet, and the poles carrying the wire at any of those places shall be of substantial character, and be strutted or stayed, if necessary, to stand the strain of the wire.

77. The person to whom the permission has been granted shall, upon the completion of the line, inform the Deputy Postmaster-General thereof, and an officer of the Department may then be sent to inspect the line and report whether it has been constructed in accordance with these regulations. The cost of such inspection shall be borne by the person to whom permission to erect the line has been given. If the line has not been constructed in accordance with these regulations the inspecting officer shall issue instructions as to what is required, and, on the defects being made good, a licence to use the line may be issued.

78. Should the person to whom permission has been granted to erect the line fail to construct it in accordance with, or to comply with, the requirements of these regulations, the Deputy Postmaster-General may take such steps as he deems necessary to obtain compliance with the regulations, and a licence to use the line shall not be issued until the requirements of the Deputy Postmaster-General have been satisfactorily complied with; and any expense entailed upon the Department in connexion therewith shall have been paid by the person concerned.

79. On the completion of the line to the satisfaction of the Deputy Postmaster-General, a licence to use it shall be issued. A licence-fee of 1s. per annum, payable in advance, shall be charged, irrespective of the length of the line. This fee covers only the use of one line connecting two points. If additional points are connected,

whether by means of a switchboard at a central switching point, or by direct connexions to the line, a further fee of 1s. per annum for each additional point so connected shall be charged, and, in the case of a line joining two separate holdings, a separate licence-fee shall be charged for each holding occupied by a different lessee, irrespective of the length of the line.

80. Where the line is erected partly on existing poles, the property of the Postmaster-General, a sum of 25s. per annum per mile of wire, or portion thereof, shall be charged for the portion so erected, in addition to the licence-fee mentioned, the wire on these poles shall be erected and maintained by the Postmaster-General, and the licensee must undertake to rent the line for a period of at least six years.

81. (1) If a private telephone line connect with a telegraph office, the following charges shall be payable in respect of such connexion :—

(2) For every telephone which connects or can connect with any telegraph office, whether the connexion is direct or by means of a switchboard at a central switching point upon the privately-constructed line, a fee of £1 per annum to cover the cost of attention to and maintenance of the telephone and other apparatus to be provided by the Postmaster-General for use at the telegraph office.

(3) The telephone for the use of the licensee may be either provided by him or purchased from the Postmaster-General, but must be maintained by the licensee to the satisfaction of the Postmaster-General.

82. Where two or more such telephone lines in country districts not erected, or only partly erected, by the Postmaster-General connect with any telegraph office, inter-communication between them will be given upon payment of the fees prescribed by Regulation 97, Part XIII.

83. If a private telephone line connect with a telegraph office, telegrams received or intended for transmission over the wires of the Postmaster-General in the usual way will be received or transmitted over such private telephone line on payment of the ordinary telegraphic charges only.

84. (1) Every message passing in either direction between any point connected with any private telephone line and the telegraph office to which such line connects, shall be charged for at the following rates :—

(*a*) For every message intended for delivery within a radius of one mile from the telegraph office to which the private telephone line connects ... ... 3d.

(*b*) For every message handed in at the telegraph office to which the private telephone connects for transmission over the private telephone line to the licensee's office ... ... 3d.

(2) Regulations 83 and 84 apply not only to telegrams and messages upon the business of the licensee, but also to telegrams or messages from or to any other person, which telegrams or messages may be transmitted over the licensee's wire with his consent, but no charges other than the charges specified in these Regulations may be made for such communications. (*See also Regulation* 88.)

85. The licensee shall deposit in advance with the officer in charge of the telegraph office with which the private line is connected, a sum calculated to meet the cost of all telegrams, conversations, or messages likely to pass over the line for a period of one month, such deposit to be renewed monthly, or more frequently if necessary, and the licensee must accept as correct the statement of such officer as to the charges payable by such licensee.

86. (1) For conversations over any such private telephone line connected with a telegraph office, the following charges shall be made :—

(*a*) For a messenger sent to call any person residing within the usual radius of free delivery of telegrams to the office ... ... 3d.

(*b*) For a messenger sent to call any person from beyond the radius of free delivery of telegrams, the usual porterage charges in addition to the above-mentioned charge of 3d.

(*c*) For every conversation ... ... 3d.

(2) This regulation applies not only to conversations between the licensee and any other person, but also to conversations between any two persons who use the line with the licensee's consent, but no charges other than the charges specified in these Regulations may be made for those conversations. (*See also Regulation* 88.)

87. Provided, however, that the facilities mentioned in Regulation 86 shall be given only when the telephone is so placed in the telegraph office as not to require access to the portions of the office premises which, by regulation, are not open to the public; and that the facilities mentioned in Regulations 84 (1*a*) and 86 (1*a*) *and* (*b*) shall be given only at offices where the delivery of messages is undertaken.

88. The licensee of a private telephone line shall not make any charge beyond those specified in these regulations for the transmission of any communication over such line, nor shall he receive any valuable consideration for such privilege without the authority of the Postmaster-General. (*See Post and Telegraph Act* 1901, *Section* 129.)

89. The Deputy Postmaster-General may direct an official inspection to be made periodically of such portions of the telephone lines as are not upon private lands, and the officer making the inspection may direct the licensee to make such alterations or repairs as to him appear necessary, and the licensee shall immediately carry out his directions. In the event of the licensee failing to do so within a reasonable time, the officer shall report to that effect, and the licence to use the line may be cancelled. Periodical inspections under this regulation shall be made free of cost to the licensee of the lines.

90. (1) The licensee shall be wholly responsible for the repair and maintenance of the line (except as regards the portion of it erected on poles the property of the Postmaster-General, and therefore maintained by the Postmaster-General) to the satisfaction of the Deputy Postmaster-General, and he shall undertake to maintain the same in a thoroughly efficient manner at his own cost, and any alterations, repairs, or other works which the Deputy Postmaster-General may, in the interest of the public safety or convenience, order to be done, shall be performed by the licensee, or, if undertaken by the Department, shall be charged to the licensee, in which latter case the amount due may be recovered by the ordinary process of the law.

(2) If any portion of the telephone line is erected and maintained by the Postmaster-General, means will be provided by the Department for separating the portion from the privately-constructed portion at will, so that defects may be localized.

91. The licensee of a private telephone line shall be responsible for any injury to life, limb, or property caused by the poles, wire, or other parts of the line (except, however, such portion of the line as is erected on poles the property of the Postmaster-General, or which is maintained by the Postmaster-General).

92. Where a private telephone line does not connect with a telegraph office, the licensee shall undertake that it shall be used for his own private purposes only, or by those authorized by him with the approval of the Deputy Postmaster-General to connect by telephone *en route*.

93. In the event of a private telephone line being found to interfere in any way with the erection of any line by the Postmaster-General or the Railway authorities, the Deputy Postmaster-General may direct that the private telephone line be altered, removed, re-erected in another position, or otherwise dealt with, as he deems necessary.

94. (1) The Deputy Postmaster-General may authorize the use, by any Government official on public business, of any private telephone line erected under the provisions of these regulations.

(2) If the licensee of a private telephone line refuses to allow any such official, authorized as aforesaid, to use such line, the licence issued in respect thereof may be cancelled.

95. All fees must, unless otherwise provided by these Reguations, be paid annually in advance.

PART XIII.—TELEPHONE LINES IN COUNTRY DISTRICTS PARTLY ERECTED BY THE POSTMASTER-GENERAL, AND WHICH CONNECT WITH TELEPHONE EXCHANGES.

97. Where privately-constructed lines exist, or are subsequently erected to connect with any town in which a telephone exchange is in operation, or to which a telephone trunk line connects, they may be connected with the telephone exchange or trunk line switchboard on the following terms:—

(*a*) If poles of the Postmaster-General are available, the portion of the lines within the boundaries of any township shall be erected and maintained thereon by the Department.

(*b*) Where poles of the Postmaster-General are not available, and it is not considered desirable that they should be erected by the Department, permission may be given for any portion to be constructed by the user of such privately-constructed line.

(*c*) Where the portion of the line erected by the Department joins the portion erected by the user, the Department will provide a means of separating the two portions at will, so that defects may be localized.

(*d*) For any portion of the line erected by the Department the following annual charges shall be made :—

For any distance up to one mile, £4.

For each additional half-mile or portion thereof of single wire, 12s. 6d.; of metallic circuit, £1.

(*e*) In cases where the line is extended so that more than one point can communicate with the exchange—

For each additional point £2

(*f*) Mileage of the portion of the line erected by the Department will be calculated radially from the exchange as a centre.

(*g*) The charges specified in (*d*) and (*e*) include—

(1) 190 originating calls per quarter from each station through the exchange.

(2) Unlimited calls between any two stations on the same line, such calls not requiring the attention of the exchange.

(3) Provision of all apparatus at the exchange or trunk line switchboard.

(4) The transmission by telephone, without extra charge, of telegrams on which the ordinary charges for transmission over the wires of the Postmaster-General have been paid.

But the provisions of Regulations 84 and 86 shall apply and the charges specified therein be made when the services provided for therein are required.

A licence-fee of 1s. per annum shall also be paid.

Calls through the exchange beyond 190 per quarter per station connected shall be charged one halfpenny each.

98. A person by whom any portion of such a line has been erected shall construct and maintain it, and maintain the instruments connected with it to the satisfaction of the Deputy Postmaster-General. The Postmaster-General will not be responsible for any portion of the line not erected by or for the Department.

The telephones for use on the lines must be of a pattern approved by the Deputy Postmaster-General, and must be maintained to his satisfaction by the licensee.

99. The cost of any necessary inspection of the line or instruments connected therewith shall be paid by the person for whose use the line has been erected.

100. Should the person using the line not maintain the portion constructed by him, or the instruments connected therewith, to the satisfaction of the Department, after reasonable notice has been given him so to do, the service at the exchange may be discontinued without prejudice to the right of the Postmaster-General to recover any fees payable by him.

101. (1) Where any line of the Postmaster-General is erected on the same route as a privately-constructed line, the Deputy Postmaster-General may call upon the owner of the latter line to remove it, and the owner may be allowed to use, in lieu of the line to be removed, a wire upon the poles of the Postmaster-General, on the terms prescribed by these Regulations.

(2) The Postmaster-General may take over any privately-constructed line if it is suitable, on such terms as are agreed upon.

102. Where they do not conflict with any regulation in this Part, the regulations contained in Part XI. shall also apply.

PART XIV.—ERECTION OF PUBLIC TELEGRAPH OR TELEPHONE LINES UNDER GUARANTEE

103. Any person may apply in writing to the Postmaster-General for the construction of a telegraph or telephone line under these Regulations.

104. Each application will be dealt with on its merits, but no application will be granted unless the Postmaster-General is satisfied that the line applied for is required in the public interest.

105. No application shall be granted for the construction of a line not likely to yield a minimum revenue within a period of eight years after the construction of the line, unless the Postmaster-General is satisfied that there are special circumstances rendering its construction desirable.

106. If the line is not likely to yield, annually, an amount sufficient to provide—

(*a*) For the cost of operating the line; and

(*b*) Ten per centum on the cost of constructing the line and supplying the instruments (to cover maintenance, renewals, &c.)

(which amount is referred to in these Regulations as a minimum revenue), the

applicants shall, for the purpose of guaranteeing the receipt of that amount, comply with the following conditions, namely :—

(*a*) The applicants shall deposit with the Postmaster-General a sum of money equal to the difference between the estimated revenue from the line for two years and the minimum revenue for two years.

(*b*) The applicants shall enter into a joint and several bond, in a sum to be fixed by the Postmaster-General, conditioned to make good, to an extent not exceeding the difference between the estimated revenue and the minimum revenue, any sum by which the receipts from the line in any year, during a period of seven years after the completion of the line, fall short of a minimum revenue.

107. The sum deposited with the Postmaster-General shall be placed to his credit in a Savings Bank, and such sum and any interest thereon shall be available for the purpose of making good in any year any amount by which the yearly receipts from the line fall short of a minimum revenue, and the sums required for that purpose may be withdrawn from the bank and paid to the Consolidated Revenue Fund at such times as the Postmaster-General thinks proper.

108. The bond shall be in a form approved by the Postmaster-General, and payments under it shall be made within one month after demand by the Postmaster-General; but no such demand shall be made so long as the sum deposited, or any balance thereof, is sufficient to make good the amount required.

109. After the expiration of seven years from the completion of the line, the bond may be renewed or a new bond executed for such further period as the Postmaster-General directs, and if the bond is not so renewed, or a new bond executed, the Postmaster-General may, unless he is satisfied that the line will yield a minimum revenue, remove it and the instruments.

110. Any balance of the sum deposited or interest thereon may, after the expiration of seven years from the completion of the line, be returned to the applicants.

111. The line and instruments shall remain the property of the Postmaster-General.

PART XV.—PUBLIC TELEGRAPH (OR TELEPHONE) LINES ERECTED AND MAINTAINED BY THE PERSONS DESIRING SUCH LINES, INSTEAD OF BY THE DEPARTMENT UNDER GUARANTEE.

112. In cases where the estimated probable telegraph (or telephone) revenue is not sufficient to justify the erection and maintenance by the Department of a telegraph (or telephone) line for public use without guarantee, and where it is considered by the persons applying for the erection and maintenance of a telegraph or telephone line, that it will be to their advantage to construct and maintain the line at their own expense, the Postmaster-General may authorize the construction and maintenance of the line by those persons subject to the following conditions :—

1. The erection of the line shall be subject to the Regulations contained in Part XI. of these Regulations, so far as they are applicable, but so that—

(*a*) Notwithstanding anything contained in the *Post and Telegraph Act* 1901, or in any regulations, the persons constructing the line shall not have or exercise any power to enter upon or interfere with any private land without the consent, in writing, of the owner thereof, the onus of obtaining which consent to lie upon the persons constructing the line.

(*b*) Where the line is erected upon private land, the method of construction shall be at the option of the persons constructing the line, subject to the approval, in writing, of the owners of the land, the onus of obtaining which approval shall lie upon the persons constructing the line.

(*c*) Where the line is erected upon public land of the Commonwealth or of a State, or on or across a road, railway, track, or other place used for traffic or accessible to the public, the method of construction, and the poles and other material to be used, shall be subject to the approval of the Deputy Postmaster-General, but the approval shall not be unreasonably withheld.

(*d*) No licence-fees shall be charged.

2. The persons constructing and maintaining the line shall nominate and submit to the Postmaster-General the names of one or two persons as the trustees for the line, to represent them, and to receive on their account the amounts payable by the Postmaster-General, as hereinafter provided, for the use of the line for public purposes.

3. Upon the completion of the line the Postmaster-General may make arrangements for its use for public business, and provide for such attendance as may be necessary for operating the line at the cost of his Department.

4. The charge for the use of the line by all persons, including those by whom it has been erected, and by whom it is to be maintained, shall be those prescribed by the Act or Regulations, for the time being, for telegrams or telephonic conversations.

5. In consideration of the erection and maintenance by the persons concerned of the line for public business, the Postmaster-General shall pay to the trustees for the line such a sum as is from time to time agreed upon, but not more than will equal a payment for every message transmitted from the new offices on the line of two-thirds of the rates prescribed for suburban telegraph messages, or not more than two-thirds of the rate prescribed for telephonic conversations with the office with which the line is directly connected.

6 The Postmaster-General may at any time take possession of the line, paying to the owners thereof such compensation as is agreed upon, or, failing agreement, as is settled by arbitration, as provided by section 155 of the *Post and Telegraph Act* 1901.

PART XVI.—MISCELLANEOUS.

113. Amendments may from time to time be made to the Regulations, and amendments so made may be made applicable to the services established before the commencement of those amendments, as well as to services established after the commencement of those amendments.

114. On being given a telephone service users shall, in all cases, agree to be bound by the several provisions of the Regulations in force from time to time

115. (1) In any case where it is desired or proposed to open a telephone exchange, and the provisions of the several parts of these Regulations do not appear to apply, full particulars should be furnished to the Deputy Postmaster-General as to—

(*a*) The number of persons who propose to join the exchange.

(*b*) The points to be connected, with radial distance from the post office.

(*c*) Information respecting any portion of the lines which can be erected by the applicants in conformity with the Regulations

(*d*) Any further information required by the Deputy Postmaster-General.

(2) Upon receipt of the required information, the Postmaster-General will determine whether the exchange is to be opened, and, if so, under what conditions and rates.

XI.—AGRICULTURAL EDUCATION.

R. Sillett, Principal, Gippsland College, Sale.

When we consider the average yield of wheat and other cereals in our own country—from 8 to 10 bushels of wheat per acre and other cereals in proportion— and then notice the average yield in the old land—as high as 28 bushels of wheat per acre—we must wonder what cause is at the root of all, and are, perhaps, tempted to say that the differences of climate and of rainfall have got everything to do with it. No doubt these things account very largely for our small average yield, compared with that of Britain and other old world countries, yet there must be something else that helps to make the discrepancy. The want of fertility in our soil cannot account for the difference, as the soil compares favorably with that in most parts of the old world. Knowledge of how to treat the soil to the best advantage, and to supply the necessary manures and fertilizers will no doubt in time bridge over, to a great extent, the great discrepancy, and help us to get much better returns from our land, and this knowledge is to be acquired by agricultural education.

At the beginning of last century, the Black Isle, lying between Cromarty and Moray Firths, in the north-east of Scotland, was a barren stretch,

of land, deemed incapable of improvement, and supporting, at most, only a few crofters. Mr. Middleton, a Northumbrian farmer, was allowed to take up a large portion of this country free of rent for the first few years, and at a small rental, 2s. 6d. per acre, for the rest of a nineteen years' lease. At the present time three of his sons farm the same land, paying about £3 per acre rent. The farms are models of improvement, and in spite of the drawbacks of remoteness from any large market and difficulty of transit, the sons seem to have less difficulty in finding the £3 per acre than the father had in finding 2s. 6d. What made the difference in the rental value of the land? Chiefly practical and scientific knowledge applied to farming.

How many of our young people do we see drifting from the farms to the large cities, leaving the healthiest, and, if carried out on proper lines, one of the best occupations of all time—that calling which provided Rome with Cincinnatus, twice the saviour of the Republic, and that occupation which a Roman Emperor preferred to the lofty but trying glories of his throne, leaving those pleasures of which the Roman poets, Virgil and Horace, and scores of poets since, have written and sung; that industry in which one may live and thrive without doing any harm to any competitor, but in which the more one produces only brings greater credit on himself, greater gain to his country, and more happiness to the street-bred folk, whom he helps to supply with cheaper food; that calling in which we may have leisure and opportunity to enjoy the seasons as they come and go. I think one of the main factors to hinder this continual drifting to the towns will be found in the teaching and spreading of the principles and practice of higher agricultural education. We live in an age whose characteristic is said to be thoroughness, and we belong to a race that prides itself in being thorough. It is this thoroughness which obtains the credit of placing us in the front ranks of progressive people. Judged by progress, made generally, we have no cause to be ashamed of our thoroughness. But for our thoroughness to be effective, we must notice things as they are, and reason and conclude therefrom. A century and a half covers the time between Black's investigations into the fertilizing properties of soot from the chimney, and Curie's discovery of radium, with all its immense possibilities. One hundred and fifty years ago the effects of nitrogen compounds on vegetation were not understood; now we are investigating the very origin of vegetable life. The science of chemistry is only one of the many branches of knowledge which the farmer must lay under contribution, if he is to make the best of his possibilities. Just as "the farmer feeds them all," so does he exact from all the sciences somewhat towards his own maintenance and progress, and no one, I hope, begrudges him what he gets. But the application of scientific principles to the great accumulation of applied sciences, which we call agriculture, although sure, makes but slow progress. This is due to two great factors—the conservatism of the farmer, and the expense of acquiring the requisite knowledge. Probably the financial difficulty would vanish if the other difficulty could be removed.

But it is against all natural laws to expect the farmer to be anything but conservative. Every man is conservative where his own occupation is concerned. It was a barber who made our first spinning machine. Had Arkwright been reared a cotton-spinner he would quite possibly have invented a machine for the manufacture of wigs. And we find that the improvements in applied science which we have to thank for our progress

have, in many instances, been due to the efforts of non-farmers. Now, every thinking farmer knows the benefits to be derived from a knowledge of a system of thorough scientific farming; but how is this knowledge to be acquired? On the ordinary farm it cannot be gained. In this age of progression, we must keep abreast of the times. Chiefly from the want of co-operation amongst farmers and from a somewhat supercilious contempt for theoretical farming, agricultural education has been neglected, and while the sum of £16,000 has been spent annually on Schools of Mines and of Arts, not the sum of £1,000 has yet been laid out in building an Agricultural High School. And when we consider that the products from the soil of Victoria reach a total of £20,000,000 per annum, while from all sources of mining they reach but £3,500,000, we certainly feel that agricultural education has been somewhat neglected. Good work has been done, and is being done, in State schools by Nature-study, observation work, and in some cases by the study of agriculture. These all trend in the right direction, and will bear good fruit in the future; yet how can the ordinary country teacher, with twenty-four different subjects, taught single-handed to eight different classes, be expected to be very enthusiastic on this one particular subject.

The Agricultural Department, by means of farmers' lectures and classes, dairying instruction to creamery and butter-factory managers, experimental plots, and in many other ways (especially one lately introduced by the present Director, who, by experimental fodder plots and silos, has striven to show how that dread scourge to northern herds, dry murrain, may be combated) is doing good work, but something more than all these is required to hasten knowledge in that science on which the welfare of the whole State, nay, of the whole world, depends. for, if the tillers of the soil were to strike *en masse*, what would the rest of the world do? We do not by any means begrudge the amounts allotted to the Schools of Mines and Arts, as we indeed recognise the many obligations we are under to the mining industry for its great benefits in the past, but when the glories of Ballarat and Bendigo form ancient history, and the wealth of Mount Morgan and of the Great Boulder grow dim in the grey vista of years, as in the first days when the "Gardener Adam" was driven from Eden, and bidden to till the ground, so till the last trump shall summon him from his tillage, shall the farmer and his work continue.

Hitherto, although the fees for instruction at Dookie Agricultural College have been very small—£25 per year, and a little additional charge for books, medical attendance, laundry work, &c.—for this sum agriculture, with all its scientific principles of botany, zoology, geology, besides viticulture, poultry farming, veterinary science, &c., has been taught. Many of the old pupils have been successful in obtaining positions of importance in this and other States, one being chief dairy expert in South Australia; another fills the post in London of Inspector of Victorian Produce; one is horticultural editor of a leading Melbourne weekly; another manager of an experimental State orchard in New South Wales; and one manager of an experimental farm in Queensland; several, including Mr. Rudduck, veterinary instructor, are veterinary surgeons, while in the recent examination for dairy supervisors, five of the twenty-two successful candidates were old Dookie students. Yet, notwithstanding all these benefits and the solid advantages to be obtained for his son and himself from the former's course at Dookie, the struggling farmer is debarred in many ways

from making use of these benefits. Not only must he find the money that would be required for fees, &c., needed to supply the necessities of his other children, but he would be doubly burdened by losing the services of that youth often of more use to him than a man. And so he plods along in his old way, sometimes envying his more fortunate brother, who has been able to make the most of the opportunity thus offered by Dookie, sometimes, it is feared, decrying the advantages of scientific farming in general, and Dookie in particular.

Now, since agriculture has been made a subject for a course at the University, in conjunction with Dookie, care should be exercised lest the practical part of agriculture should be left too much in the background. After the course at the University, one year of practical agriculture at the College has been prescribed. Surely this is barely sufficient time at practical work for a man to receive a diploma on; besides, would it not be much better to receive the first part of the training at a college where agriculture is in the ascendant than at the University, where it is not so. We are all agreed about the necessity of improving the general average of the grain yield, and thereby the farmers' and the country's wealth, and of hindering as much as possible the drift of the rural population to the metropolis, and large towns, and of placing our nation in the van with other progressive nations. Seeing that agriculture is in such an overwhelming degree the most important of all our industries, and is the mainstay of all our national and commercial prosperity, surely we are not seeking too much when we ask that one or two Agricultural High Schools shall be opened in populous farming centres on the same lines as the Continuation School in Melbourne, and on the basis proposed by the Director of Agriculture, saving that the Departments of Agriculture and Education take over the burden of expense until such time as the general community can appreciate the good work done. If, in addition to this, five scholarships for Dookie or Longerenong, were given by the Council of Agricultural Education, and five more by the Government, one through each group of the district societies, and these scholarships, given annually and for a two years' course, not as now triennially and bearing a three years' course, not for excellence in scholarship only, but marks to be allowed also for experimental work done at home or at school or by some other proof to an inspector of schools that the boy has a predilection for agricultural pursuits, a lad whose parents are in somewhat straitened circumstances, would have a chance of graduating through State school, Dookie College, and the University, and thus a comprehensive system of agricultural education would be complete. These scholarships should be, as much as possible, confined to the sons of struggling farmers.

And further, as aids to awaken and sustain interest in agricultural and rural pursuits, and also as a means of real benefit, let organized visits to Dookie and Longerenong, of farmers and farmers' sons, and where practicable of elder school lads under the supervision of their teachers, be made at reduced railway fares in the same manner as students of Schools of Mines are allowed to travel, or let even greater facilities be allowed, as the distances would, in many cases, be much greater. Now we know we have the sympathy of the Directors of Agriculture and Education in this matter of higher agricultural education, and we believe we have that of the Ministers of these two most important Departments; and, since the Premier declared at Brighton just

the other day that he meant to advance agricultural education by all means in his power, let us hope that our modest wishes, as here so feebly set forth, may, ere long, end in happy fruition.

God Speed the Plough.

XII.—HEREDITY IN STOCK-BREEDING.

Address by S. S. Cameron, M.R.C.V.S., Chief Veterinary Officer.

On the occasion of the Convention at Horsham last year, I read a paper of considerable length, and I feel quite assured that, if one's duties permitted it, a Convention of this kind, which might be regarded as the High Parliament of agriculturists, should be paid the compliment of that careful preparation which the writing of a paper involves. I did not write a paper on this occasion, partly because of the calls made on my time by the coming into force of the new Milk and Dairy Supervision Act, but particularly for the reason that at the Horsham Convention there was distinct evidence of the fact that more value was placed upon the exposition of any subject which happened to be brought up by members in the discussion which followed. Consequently, when I was asked by your secretary to give an address at this Convention on the subject of "Stock matters generally," I was rather delighted at the wide scope given. Later on I was asked to name a subject, and, while I named "Heredity in Stock," I still felt that more good would result from an exposition of any subject in connexion with diseases in stock which any of the audience might wish to have expounded. And I am confirmed in this opinion by the fact that since my arrival in Sale a request has been made to me that I should say something during the proceedings of the Convention on the subject of "Cripples," that disease which is so widespread, and which is causing such heavy mortality amongst the dairy cattle of the country. However, a short address on the subject of "Heredity in Stock-breeding" will serve as an introduction.

One of the things I had in mind in deciding on this subject was to attract attention to the question of the unsoundness or soundness of the horse stock of the State, and a few general remarks on the laws of heredity will quickly bring me to that point.

One of the most glib and best-known laws of heredity is that "like produces like," but as it is usually accepted or interpreted that statement or law is a great error. Like only produces like when all the factors and conditions are exactly similar. How often in practical breeding operations does this exact similarity obtain? Very seldom, if ever. It therefore happens that the progeny of two animals when mated together always shows some dissimilarity to the parents. The colt of one year shows some dissimilarity to the filly of the following year. No human beings—no two brothers or sisters—are alike. This variation depends on many things—some unknown, others known, such as the surroundings, food supply and

the like. You may take it then, and those who have had practical experience of breeding will bear me out in the statement, that the law of variation obtains much more in practical breeding operations than the law that like produces like. The practical application of that statement is that animals which diverge widely in form, colour, or characteristics should not be brought together for breeding purposes if unexpected results are to be avoided. An illustration will serve to make my meaning more clear. It is very much like two converging streams of water. If they are flowing almost parallel to each other, and are equal in volume and rapidity of flow, they unite harmoniously; but if the volume and rapidity of flow are unlike, and the streams unite at a sharp angle, then all sorts of counter-currents and unexpected results happen, and so it is with bringing together, for breeding purposes, animals which are unlike. A safe method is to put a like dam to a like sire, and then you have some chance of not being disappointed. Thoroughbred when mated with thoroughbred produces thoroughbred; Clydesdale when mated with Clydesdale produces Clydesdale; but to mate a half-bred mare, whose breeding history you do not know, with a thoroughbred sire, is to place yourself in the position of not knowing what you are likely to get. The game is still more uncertain when both sire and dam are crossbred, and particularly when their breeding history is not known. It is on account of this lack of knowledge of the breeding history of parents that great disappointment and unexpected results ensue. It is not so much a question either of the immediate parents being apparently suitable mates, through their similarity, but that such similarity is due to their having been bred on similar lines—a mere accidental similarity or apparent suitability is not enough.

I have mentioned that variations occur on account of differences and conditions either in sire or dam, in surroundings, food, or other governing factors at the time breeding operations are being carried on. Even slight variations in the progeny continued through successive generations result in the variations or changes becoming permanent, and advantage has been taken of the fact that variations do become so fixed to effect improvement in breeding of horse stock. Any variation for the better is noted, and an attempt is made in mating to perpetuate the advantageous variation, and so fix it. As the law of variation has been taken advantage of by shrewd breeders to improve and develop good points, so it should be taken advantage of to avoid defects. This brings me to the subject of defects. I am not going to refer to those defects of form which are a matter of opinion—for example, as the shape of a horse's head, his length of neck, his width of loin, his breadth of hips, or other like matters of conformation, opinions on which are largely based on the judgment of experienced men from time immemorial. I am going to refer particularly to those defects of conformation which are handed down from the parents to the offspring, and which when existing in an animal constitute in that animal a predisposition to unsoundness, or a predisposing cause of a disease which constitutes unsoundness. Strictly speaking, there is no such thing as hereditary unsoundness. The tendency at the present time in scientific circles is to interpret the word inheritance as meaning the possession of the quality inherited at the time the animal is born, and in that strictly scientific sense few, if any, unsoundnesses are inherited. No one, for instance, has seen a horse born with a ringbone, sidebone, curb, or, except in odd

instances perhaps, any of the defects which constitute unsoundness in horse-flesh. This I desire to particularly impress: that it is not the disease itself, it is not the enlargement of joint, nor the inflammation preceding such enlargement, which is inherited. But what is inherited is that conformation—of the pastern, say—which on the application of a certain cause will result in the horse developing a ringbone. It is the short, upright pastern which is particularly prone to the development of ring-bone, that is inherited. This conformation of pastern tends to accentuation of concussion when the horse is put to work; and inordinate concussion results in the formation of a ringbone, with its accompanying pain, inflammation, and lameness. Similarly with regard to breeding from a horse that is tied in below the hock. A horse having that type of hock, with a good breadth from the front to the point of the hock, but narrow at the junction of the hock with the cannon, is liable to develop a curb at any time on the incidence of extra strain on the part. A sire and dam possessing this defect of conformation, predisposing to curb, will have progeny possessing the defect. In a great number of cases, if the sire alone possesses the defect, the progeny will have the defect, particularly if the sire happens to be an animal which possesses in a great measure that quality known as prepotency. I have said that a sire affected with ring-bone will have progeny which is not so affected until the progeny is subjected to the same conditions of work which produced the ringbone in the sire. It is when the progeny reaches the age of three or four years, when it is put to hard work, particularly on hard roads, that the ill-effects of the concussion will result in that inflammation of the pastern from which a ringbone is developed. Similarly in the case of a sickle-hocked horse. If such a horse be not subjected to any excessive strain he will possibly never develop a curb, but if, on the other hand, a horse with that weak conformation below the hock be subjected to some special strain, as when the horse is jumping a fence, or, in the case of a draught horse, when a heavy strain is occasioned in drawing a load up a hill, then the weakness will manifest itself, and the sinews binding the hock bones together at the back will become strained, and the resulting enlargement is a curb. While disease and unsoundness are not in themselves inherited, but only the tendency or predisposition to the development of disease is inherited, I want to emphasize the point that for all practical purposes it amounts to the same thing. It is the same with tuberculosis in cattle. The disease itself is not inherited. There have been perhaps one or two isolated cases recorded in which calves have been born with tuberculosis. These records may perhaps be questioned, and in any case they are not of sufficient importance to upset the general statement that tuberculosis is not inherited. It is the vulnerability to the disease, the lack of resistance to the invasion of the germ causing the disease, that is born with and is possessed by the progeny.

I would like to say here that, as practical stock-breeders, as men whose success in life depends on the kind of animal you produce, you should pay most regard to the production of stock which is of the highest value. I do not wish to make any wild or alarming statements as to the prevalence of unsoundness in the horses of this State. But I do know that the value of the horse-breeding industry is largely decreased by the unsoundness of horses that would otherwise be saleable and exportable. No Indian buyer will touch a horse with the slightest blemish, approaching an unsoundness. No shrewd local buyer will purchase at anything like

full price an animal with such defects. Hence it is, in large measure at all events, that horse-breeding is often unprofitable. When through the existence of unsoundness or defects that promote unsoundness less than 50 per cent. of the sound value is realized for young stock the unprofitable nature of the undertaking is apparent.

The question of soundness in brood mares is, of course, of importance, but I know that in actual practical affairs a farmer cannot very often afford to reject for breeding purposes a mare that happens to be unsound. While not actually advocating breeding from unsound mares, I wish to put it strongly that the harm is infinitesimal compared with breeding from unsound stallions. Only one foal is prejudiced each year, whereas in the case of an unsound stallion a good proportion of the whole crop of foals in a district may turn out useless. Consequently, in the majority of cases the defects in young stock are produced by the stallions, and I think that some steps should be taken whereby it might be warranted that a horse standing for breeding purposes should be sound. I go further, and say it should be the duty of the agricultural societies to see that they do not give prizes to unsound horses, and I may tell you that so long as I remain in the Government service so long will my endeavours be directed towards seeing that the money paid by the Government as a grant to agricultural societies will not be given to the encouragement of unsound horses. Many breeders have no other guide as to the excellence of a horse than the records of show prizes, and so long as such prizes may be won by unsound animals it is unfair to blame owners of mares for patronizing them.

The matter of the rejection, so far as prize money is concerned, of unsound horses at shows is a question that can be dealt with in various ways, but it has struck me that one of the ways in which sound stallions could be assured to a district is by agricultural societies arranging for the holding of a parade prior to the commencement of the breeding season, at which all stallions it was proposed to stand in the district that season might be examined for soundness. Although I have no authority for saying so, I believe that if representations were made in the proper quarter arrangements might be made whereby the Department of Agriculture would undertake the examination of stallions at such parades free of cost, and issue a Government certificate of soundness in respect of all animals found free from hereditary or transmissible unsoundness. Such a Government certificate might be termed, and would be considered, the "hall mark" of soundness in breeding stock. It would then be left to the people of the district to select the "hall-marked" stallions or those which were not "hall-marked." At all events, the breeders would then have only themselves to blame for the ultimate loss and failure if they deliberately chose to breed from other than guaranteed sound animals. If this suggestion is considered to be of any value it might be worth while to pass a resolution with the object of bringing it about.

Considerable debate followed on Mr. Cameron's address, and at a later session of the Chamber the following resolution, proposed by Mr. O'Connor (Yarram), was carried unanimously:—

That it be a recommendation of the Chamber of Agriculture to the Minister of Agriculture to arrange, on the voluntary request of any Agricultural Society or Parade Council, for the free examination for soundness of stallions standing for public service by approved veterinary experts, and for the granting of Government certificates of soundness."

In response to the action of the Chamber of Agriculture, the Minister of Agriculture (Hon. Geo. Swinburne, M.L.A.) has decided to adopt the suggestion embodied in the above resolution. The Department of Agriculture will, on the request of Agricultural Societies or Parade Committees, make the necessary arrangements for veterinary inspection at all shows and stallion parades, and for the issue of a Government certificate of soundness to all animals found free from hereditary unsoundness at the time of examination. Applications should be made to the Secretary for Agriculture, Melbourne.—Editor.

XIII.—CRIPPLES IN CATTLE.

Address by S. S. Cameron, M.R.C.V.S., Chief Veterinary Officer.

With regard to the subject of cripples in cattle, I wish at the outset to say that, when I have finished, I will be willing to plead guilty to a charge of having been theoretical, because as a matter of fact our present state of knowledge of the subject is so nebulous that there is nothing of a really scientific or proven character to expound to you. In the first place, I should perhaps say that under the name of "Cripples" in different parts of this State there are included either a number of different diseases, or else different manifestations of the same disease. In some parts a disease which, after its first stages, is manifested by an alteration in the character of the bones, is called cripples. In other districts a disease which, in its later stages, is associated with inflammation of the feet, somewhat identical with founder or laminitis in horses, is known locally as cripples. Then there are diseases which are known by the name of the district. For instance, the Winton disease is closely allied to the disease known in other parts as cripples. The disease in the Western district, known as Yambuk disease, is apparently a form of the same trouble.

Generally speaking, the disease is associated with that very common condition in dairy cattle called impaction. Another common symptom, in addition to impaction and unthriftiness, is loss of proper co-ordination of movement. An impression prevails that the impaction is caused by the dryness or non-succulence of feed, and is in turn the cause of the other derangements associated with the disease. While that may be so in some cases, it is very difficult to account for the subsequent symptoms on the supposition that dry food alone is the cause. For instance, shortly after the disease attacks an animal, there are manifested a number of paralytic symptoms, such as loss of power to swallow, and loss of the power of locomotion. As a matter of fact, there is associated with impaction a paralysis of certain nerves, and in my opinion this paralysis is the cause of the impaction, and not the result.

A short anatomical explanation will make my meaning more clear, and will enable you to understand in some degree the part played by nerve derangement in this disease. All animals have what are known as the cranial nerves. There are 12 pairs of these, arising from the base of the brain, and they are distributed to the anterior part of the body. They

are named numerically from one to twelve. The first (olfactory) is the nerve that has to do with the special sense of smell; the second (optic), with the sense of sight; the third controls the muscles of the eye-ball; the fourth supplies one particular eye-ball muscle; the fifth is a large one distributed throughout the head, and controls the muscles of mastication; the sixth goes to a muscle of the ear; the seventh controls the muscles of expression—the eyes, ears, nostrils, and lips; the eighth is specially concerned with the function of hearing; the ninth supplies the pharynx, and promotes the function of swallowing; the tenth is the pneumo-gastric nerve, which has three important functions — it supplies the lungs, and accelerates respiration, it steadies the action of the heart, and it is the motor nerve of the muscular walls of the stomachs; the eleventh has to do with the muscles of the neck; and the twelfth supplies the root of the tongue with nerve power. Now, in cripples there is a paralysis of all those parts, organs, and functions, controlled by two only of the cranial nerves—the ninth and tenth. In the case of Yambuk and Winton diseases, such paralysis is the most marked feature. It is true that the spinal nerves must be affected in some degree to account for the unsteady gait and partial paralysis of the hind-quarters; but with this exception every function of the body controlled by nerves other than the ninth and tenth cranials is performed normally in this disease; on the other hand, every function controlled by these nerves is paralysed. The inability to swallow, and the hanging out of the tongue in the later stages, is due to paralysis of the ninth cranial nerve. More marked still is the loss of function of those parts and organs that are controlled by the tenth cranial nerve, the pneumo-gastric. When this nerve is acting properly, it keeps the action of the lungs up to proper pitch. In Winton disease, which may be considered the most serious manifestation of cripples, the respirations are lowered because of the fact that the pneumo-gastric nerve is more or less paralysed. The same nerve has a steady or regulating effect on the movements of the heart, and when it is cut for experimental purposes, the heart is caused to beat very rapidly. In Winton disease, there is an increase in rapidity of the action of the heart, along with the lowering of respiration—a most unusual combination of symptoms pointing plainly to the fact that the one nerve is responsible. It is also one function of this nerve to stimulate the muscular walls of the stomach, and to bring about that movement of the stomach and churning of the food which goes on naturally. In Winton disease, there is no movement of the stomach at all. As the animal eats the food simply lies there, without being digested or moved on, and the stomachs become impacted. Even the gall bladder, which is supplied by terminal filaments of the tenth nerve, is also paralysed, and unable to empty its contents, so that it is always found full and distended with bile after death. This all points to the same condition of paralysis or loss of power of the pneumo-gastric nerve. The remainder of the alimentary canal beyond the stomachs—the intestines—which depend for their action on other nerves, continue to act normally, as shown by the fact that they are always found empty on *post-mortem* examination. The contrast between the "deadness" of the stomach and the normality of the intestines was plainly demonstrated during an experiment I conducted. I opened up a cow in the flank, and found that the stomach was completely without movement, yet through the same opening I hauled out a quantity of the intestines, and found they possessed the same motion as ordinarily—the normal peristaltic motion. As I have said, a *post-mortem*

examination always shows the bowels empty and the stomach full, proving that after the paralysis of the stomach started the function of the intestines has continued.

If my theory is correct—and the conclusions seem to me to be the logical ones to be drawn from the facts—then it may be said that the pathology of Winton disease form of cripples is fairly clear; but as to the causation of it we are in the dark. In this connexion, and as indicating a possible channel for the entrance of infection into the brain, I wish to mention a further original observation of mine, made about two years ago. During a series of *post-mortem* examinations, in addition to the appearances usually described, I found the nasal mucous membrane enormously engorged with blood. The engorgement extended back to the bones at the base of the cranium, and its extent bore some relationship to the severity of the disease. The more acute the case, the greater and more extensive was the engorgement, while in milder long-standing cases the engorgement was less pronounced and extensive. I do not know that this observation will turn out at all important, but it points to the possibility of the brain being inoculated with something through the nostrils. It has been previously suggested that the disease might be a form of mycotic poisoning, and it is quite feasible that during the late summer months there is something in the shape of a rust or fungus or mould which develops on ripe grasses, somewhat in the nature of rust on wheat or ergot on rye grass. The *post-mortem* observation I have just now announced may go to show that when the animal is pasturing it inhales this fungus, which reaches the brain by means of the nasal chamber, and exercises a selective and paralysing effect on the ninth and tenth nerves.

Another explanation I may advance as to the causation of the disease is that on account of the non-succulence of the herbage, constipation is brought about, and allows of the formation of an intestinal toxin or poison. The toxin is absorbed into the blood, and poisons the nerve centres. This idea squares with our knowledge of the causation of convulsions in children, which are now thought to be brought about by the formation of toxic material in the intestines of the child.

In conclusion, it will almost be superfluous of me to observe that investigations need to be made in the direction of finding out whether the trouble is caused by a germ, an alkaloid or fungoid poison, or in what other way. At the present time, it seems likely that something is to be done in the way of providing a research institute for the investigation of the diseases of animals, and when the project is brought before you, I will ask you, as representatives of the agricultural and live stock interests of the State, to support the movement. I think that it is only right the wealthy stock-owners should be appealed to. Instead of looking wholly to the Government, they should be prepared to supplement the efforts of the Government with some financial assistance. There is no country in the world that has more need for such an institute. Animals are becoming more and more valuable—so much so that it might be said that the live stock of the country constitutes its national life-blood.

Discussion.

In reply to questions, Mr. Cameron said that as to the question of infectivity he was not prepared to speak at present. If the theory of the

mould poisoning turned out to be correct the disease might be considered infectious. The disease most frequently occurred on kangaroo grass country when the grass was ripe and dry. It was either a question of the dry character of the grass or a question of the grass being affected with smut or rust. One outstanding fact was that cripples never, or very seldom, occurred where the animals were fed on succulent herbage. In crippley country during the late summer months cripples could be prevented by giving succulent hand feed or bran. The best advice he could give was that, in carrying dairy stock during the late summer months, particularly on poor country, the natural dry feed must be supplemented with maize, amber cane, the different sorghums, millet, roots, or something of the kind. If these were not available, bran and treacle should be used. In some manifestations of the disease he would be inclined to say that cows suffered from cripples, although there was no impaction of the stomach, especially in the manifestations associated with rickets. In cases of so-called cripples, which lasted over a long time, during which the animal eats well, the stomach acts, and paralysis did not occur to the same degree. It was a fact that the disease occurred in all parts of the State, although there might be some special patches on which the disease did not occur. The disease was more or less widespread. He had very little sympathy with the theory of soil exhaustion. He also questioned whether the alleged deficiency of phosphates in the soil had very much to do with it.

Treatment of the associated impaction was not successful in all cases. In the first place a laxative was required, but if the paralysis was thoroughly set up it would not have much effect. The laxative should consist of the following:—1 lb. Epsom salts, 2 oz. powdered jalap, ½ oz. ginger, and ½ lb. treacle for a cow. Later on this might be followed by powders to stimulate the appetite. The powder should be made up with ½ oz. each of carbonate of ammonia, ginger, and gentian, given in cold gruel twice a day, in the early stages at all events.

The whole question was one of succulent food at the end of summer, and Dr. Cherry had been hammering away at this point for some years. The silo provided this food for the dry portion of the year, and he hoped that all the farms upon which they were erected would have definite results.

Mr. Power said it would strengthen the hands of the Government if a resolution were passed supporting the idea of a veterinary institute for research. The Government should provide funds to enable examinations to be made into the trouble caused by cripples, which was so widespread. He moved—

That this Conference highly approves of the suggestion that funds be provided to enable research to be made into the cause of cripples and stock diseases generally, and the best remedies for such.

Mr. Horstmann seconded the motion, which was carried.

On the motion of Mr. O'Connor, seconded by Mr. Kennedy, the following resolution also was unanimously agreed to:—

That the Chamber of Agriculture make representations to the Government heartily supporting the Premier's announced proposal for the establishment of a combined Veterinary Research Institute and University Veterinary School, and conveying the assurance that such an institute and school is likely to be of the utmost value to the dairying and live stock interests of the State.

MODERN BEE FARMING.

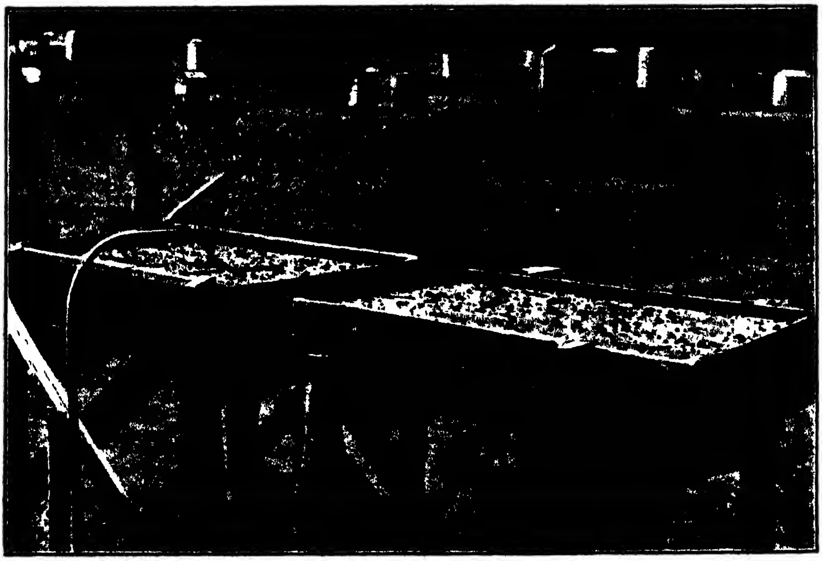
R. Beuhne, President Victorian Apiarists' Association.

PART V.—WATER FOR BEES.

Few beekeepers are aware what amount of water is required by a colony of bees during the summer months, and how important it is that a permanent supply should be available within a reasonably short distance of an apiary. As a general rule, bees are left to themselves to get their supply of water wherever they can. There is usually a natural water-course, dam, or waterhole somewhere in the neighbourhood, and if permanent and within a few hundred yards of the apiary, such sources answer well enough. When, however, water is not permanently available within a quarter of a mile, it is greatly to the advantage of the apiarist to provide an artificial supply as near the apiary as convenient. I do not think that the time occupied by the bees in carrying water over a longer distance need be seriously considered, but the greater liability of being caught by birds and insects, blown down during strong winds, or caught in rain-squalls during the longer journey is a serious matter. At the margins of dams and water-holes hundreds of bees are often destroyed within a few minutes by cattle or horses stamping them into the mud or swamping them through the plunging of the animals into the water. Where many bees are kept, and the water supply is limited, they become a nuisance to stock, and sometimes a source of ill-feeling between neighbours in consequence. Bees are also very annoying about the apiarist's own home, round water-taps, tanks, and the drinking dishes of poultry, when the weather is hot, and any other supply of water rather far from the apiary. The writer was confronted with all the troubles enumerated when first establishing his apiary in its present location; an automatic artificial supply close to the apiary has overcome these difficulties, and has now been working continuously for eight years without a hitch.

The water is obtained from the roof of the honey house and stored in two tanks of 1,000 gallons each. An iron water-pipe, laid underground (18 inches deep) so as to keep it cool in summer, conducts the water to the drinking troughs, which are at a distance of about 100 feet from the building, and the same distance from the nearest hives. This distance is necessary, otherwise the bees, when flying to and from the water, interfere with work in the apiary, and also cause confusion at swarming time. There are two drinking troughs; they are placed on a stand at a height of 3 feet from the ground, in order to prevent poultry going to them, and to keep drifting leaves and other material out as much as possible. Each trough measures 36 inches x 24 inches inside, with a depth of 6 inches, and consists of a frame made of 6 x $\frac{7}{8}$ white Baltic flooring boards, with a bottom of 6 x $\frac{1}{2}$ lining boards. It is lined with plain galvanized iron, No. 26 gauge, neatly fitted inside the wooden casing, to which it is secured at the top with fine tacks. It is better to have two or even three of such troughs instead of a large one of the same surface area as the two or three combined. If only one large trough is used the bees are too much concentrated, and a good deal of fighting and stinging takes place occasionally. It is, therefore, better to have several troughs a little distance apart, and if they are placed on the same level and connected by means of a piece of garden hose attached to a

stud at the bottom of each, one stand pipe, with automatic tap, will supply them all. On the top of each trough floats a raft, upon which the bees alight to drink, and it is so constructed that they cannot drown, and even dead bees cannot drop into the water and thus pollute it. The raft is made of slats of ½-in. lining boards, 35⅝ inches long, 15-16th inch wide, and ½ inch thick. The edges on the upper side are planed away at an angle of 45 degrees, so that when the slats are placed side by side they form V-shaped gutters, with an opening 1-16 inch wide at the bottom. Twenty-four of these slats are nailed on to three cross-pieces of ⅞-in. flooring board 23½ inches long and 2 inches wide, in such a way that the thin bottom edges of the slats are 1-15 inch apart. The raft is then fitted into the trough and dressed till a space of not more than ⅛ inch remains all around between the raft and the lining of the trough. To keep the raft always at the proper level, that is, with the water not higher



DRINKING TROUGHS FOR BEES.

than about ⅛ inch between the slats, air-cushions are fastened underneath the raft, one at each end. They are made of light zinc, such as the lining of piano or drapery cases. Fold a piece of this material, cut the correct dimensions, over a piece of wood 35 inches x 5 inches x 1 inch, solder the joints, and, after withdrawing the board, also the end. It may be tested as to being air-tight by pressing it under water to see whether air-bubbles escape; if so, there is a leak which has to be re-soldered. In soldering zinc, raw spirits of salt, diluted somewhat with water, should be used, not killed spirits (chloride of zinc); this rule also applies to galvanized iron. The solder-iron should be clean, well faced with solder, and only just hot enough to melt the solder, but not the zinc; this is only possible if the solder is of good quality. If the air-cushions raise the raft too high at first the latter should be weighted down to the proper level by means of small stones evenly distributed, and as the wood becomes saturated with water they may be removed as required. The raft of the trough, which is under the stand-pipe, has an upright iron rod

pivoted to it in the centre. This rod connects by means of a hinge-joint with a lever fastened to the head of the water tap, which is screwed into the stand-pipe, so that the cone of the tap is in a horizontal position, and, therefore, lowering the lever will open the tap, and raising close it. No dimensions for rod and lever can be given, as these depend upon the height of the tap above the raft, its distance from the centre of it, and the size and passageway of the tap itself. The measurements and the angle of bend in the tap lever can, however, be easily ascertained. The tap should be completely shut when the raft is within an inch of the top of the trough, but should begin to run as soon as the raft sinks and draws down the lever, when the water level is reduced by the bees drinking.

The accompanying illustration will give a general idea of the arrangement. The troughs shown are of the dimensions stated, and give drinking accommodation for 150 colonies. When the season is very hot and dry, and the colonies strong, a third trough is added by means of a hose connexion, as stated before. The roof of the honey house, with a ground measurement of 21 feet by 18, collects with a rainfall of 20 inches sufficient water for the bees and the ordinary requirement of extracting, &c.

There are many well-timbered areas in Northern Victoria where beekeeping could be carried on successfully, but which remain vacant owing to the absence of a water supply for the bees. Every beekeeper requires a dwelling and a building for the requirements of his business; if these are constructed in time to get a supply of water for the following season, and if the roof area is sufficient to give the required quantity with the rainfall of the locality selected, there is nothing to prevent some of the waterless, but for beekeeping, otherwise excellent country being utilized.

STATE SCHOOLS EXHIBITION.

The great advance which nature study and kindred subjects have recently made was fully exemplified at the State Schools Exhibition, held in Melbourne, from the 5th to 22nd September. The exhibition, at which the total attendances numbered 300,000, was a pronounced success both from the educational and spectacular stand-point. In several instances, notably Mortlake and Naringal, splendid specimens of agricultural produce, the results of school farming, were exhibited; these products, together with particulars relative to manures, soils, grasses, &c., illustrated how thorough had been the study of agriculture. The Wy Yung exhibits also bore striking evidence of the extent that up-to-date education is playing in the development of agricultural knowledge. This knowledge must undoubtedly have a beneficial effect both on the individual and on the community of the State generally. The exhibition has clearly shown that the teachers of the Victorian Department of Education are deserving of every encouragement in their efforts to develop the intelligence of the rising generation.

A. T. S.

GARDEN NOTES.

J. Cronin, Inspector, Vegetation Diseases Act.

The Narcissus.

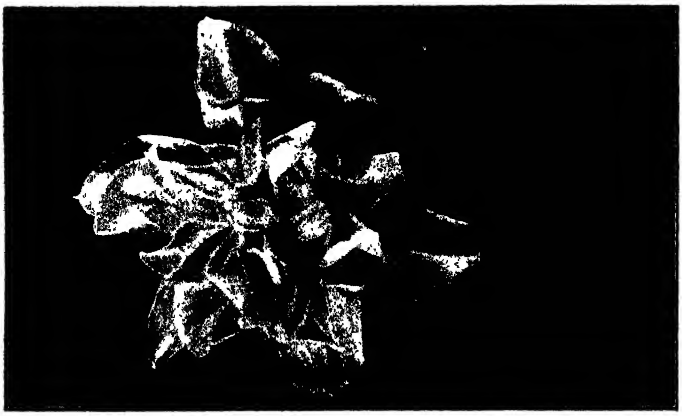
Narcissus—which includes daffodil, jonquil, &c.—is a genus of hardy bulbous plants, most of the species of which are natives of Southern Europe. A few of the original types are still cultivated in gardens, but most of the fine varieties now grown have been produced from seed. The various species have been hybridized, chiefly by English cultivators, who have produced most of the fine kinds in cultivation, and have evolved types distinct and superior to the original.

The accepted classification of the narcissus is based on the length of the cup, or tube, of the blossom, as compared with the segments of the perianth. Narcissi are divided into three main divisions or groups, viz.:—(1) Magni-coronata, or large crowns, commonly termed trumpet daffodils, in which the trumpet is as long, or longer, than the perianth; (2) Medii-coronata, or medium crowns, in which the crowns are about half as long as the sepals; (3) and Parvi-coronata, or small crowns, in which the cup is very small compared with the perianth. In this latter class are included the Tazetta, or bunch-flowered narcissi, commonly, but erroneously, called jonquils. Each main division is again divided into sections, that denote some particular arrangement of colour or form of crown. In the first division the sections are:—The major type, in which the flowers are yellow; bi-colour, the perianth of which is white and the tube yellow; white or sulphur-coloured, selfs; and the bulbocodium, or hoop-petticoat narcissi, in which the perianth is insignificant. The second division includes the *incomparabilis* group; Barrii, hybrids between *incomparabilis* and *poeticus;* Leedsii, hybrids from *montanus* and *poeticus;* Nelsonii; Humeii; and other hybrids; and *campernelli*, juncifolius, and the true jonquil, *Narcissus jonquila*. The third division includes the *poeticus;* Burbidgeii hybrids; and the tazetta or polyanthus groups.

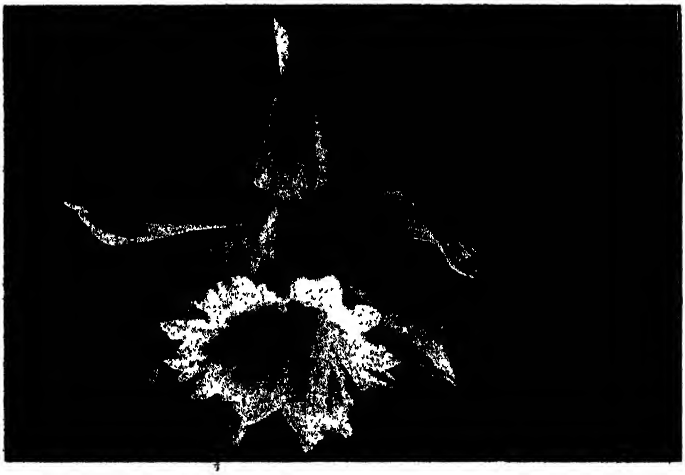
Narcissi are undoubtedly the finest of our winter and spring flowering plants, and, being of easy culture, are deservedly popular and successfully cultivated in all parts of the State. The forms or types are varied, although the range of colour is limited. A number of varieties are much earlier than the majority, while a few of the best kinds are later in their blooming. Late-flowering varieties are not recommended for the earlier and hotter districts, as the blooms are not capable of enduring hot sun or wind. A number of growers are now producing large quantities of flowers for sale for the local and Inter-State markets, and the produce earns many thousands of pounds per annum to those cultivators. In the cooler districts there is probably a fair opening for the culture of late varieties to succeed in the markets those grown in the metropolitan district.

SOIL AND CULTURE.

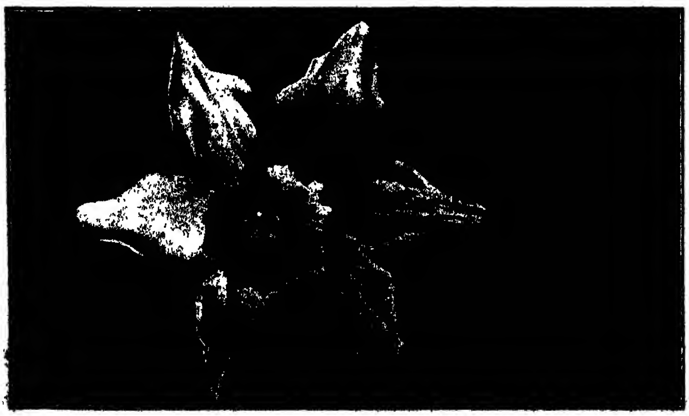
The most suitable soil for narcissi is a light friable loam. They will, however, grow and bloom well in any well-drained, fair, garden soil. The addition of fresh stable manure to the soil in the proximity of the bulbs is most injurious, and should be avoided. Well-rotted stable manure is beneficial when deeply worked into the soil well below the bulbs, but the best manure for all narcissi is a mixture of equal parts coarse bone meal



"GOLDEN PHOENIX,"
DOUBLE-FLOWERED TYPE.



"M. J. BERKELEY,"
LARGE TRUMPET SECTION.



"MINNIE HUME,"
MEDIUM TRUMPET SECTION.

and superphosphate, applied at rate of about 1 lb. to the square yard. In cool soil this manuring is quite sufficient, but in hot, sandy soils the addition of well-rotted cow manure to the bottom of the bed or patch is of special value, on account of its coolness and moisture-retaining properties. The bulbs are most satisfactory when planted in special beds, although they will succeed and often produce exceptional blooms when grown in borders among other plants. The advantage of the bed system is that the bulbs are not watered artificially in the resting period as is generally the case when they are grown in borders of mixed plants. In preparing soil for the reception of bulbs, the bed or patch should be worked

"GRAND MONARQUE," TAZETTA OR BUNCH-FLOWERED TYPE.

to a depth of about 18 inches, the manure applied to the bottom 9 inches, and the soil firmly trodden before planting. Bulbs of the majority of varieties should be planted about 3 inches in depth, very large bulbs an inch deeper, and bulbs of small and weakly-growing varieties an inch less. The bulbs should be planted from 4 to 6 inches apart, and may be allowed to remain undisturbed for three years, when they should be lifted, divided, and replanted. The bulbs are ready to lift when the tops turn yellow, and should be replanted at once, if possible. Otherwise they should be dried and stored in a cool place till the latter end of March at latest. After the flowering period is over, the bulbs should not, as is usual, be allowed to suffer from want of cultivation. The longer the "grass" is kept growing the better the blooming in the next season.

The varieties worthy of cultivation are as follow:—Long trumpet section—Yellow—Ard Righ, Maximus, Henry Irving, M. J. Berkeley, Glory of Leiden, Johnstonii Queen of Spain, Thomas Moore, Emperor, Golden Spur, King Alfred, Bicolor, Empress, Princeps (the popular and cheap market daffodil), Victoria, Madame Plemp, Grandis (late), Ada Brooke. White—*Albicans*, *cernuus pulcher*, *tortuosus*, *pallidus præcox*, Wm. Goldring, Madame de Graaf. Medium trumpet—Sir Watkin, Beauty, Frank Miles, Gloria Mundi, Gwyther, Barrii Conspicuous, Princess Mary, Minnie Hume, Duchess of Brabant, Amabilis, Katherine Spurrell, William Wilks, *jonquila, odorus.* Small crowns—Burbidgeii, John Bain, Almira, Falstaff, *poeticus ornatus, biflorus.* Double flowered—Van Sion or *telemonius plenus*, Hale's Silver and Gold, Orange Phœnix, Sulphur Phœnix, Golden Phœnix. Tazetta or bunch-flowered — Grand Monarque, Grand Soleil d'Or, Grand Primo, Paper White (the earliest market variety), Her Majesty, The Pearl, Staten General, Queen of the Netherlands.

Flower Garden.

If not already done, the most important work is the reduction of the rough surface left after digging in winter. No time should be lost, or the moisture in the soil will evaporate, and the work made more difficult later. Sandy soils can be worked at almost any time, but heavy loams are best attacked when in a half dry condition. The surface should be broken down as fine as possible, and if water is scarce a mulch applied early.

Chrysanthemums intended for exhibition should be planted this month. Early varieties are retarded somewhat in their time of blooming when planted a fortnight later than mid-season kinds, while late varieties should be planted earliest, and, if possible, in a bed by themselves. Beginners need not be dismayed at the apparent skill and knowledge required, as suggested by writers to horticultural papers on chrysanthemum culture. A fair soil, well manured and drained, with attention to cultivation, staking, and disbudding is all that is needed to produce fine flowers. A lot that is written of the need to save certain buds on a certain date does not apply generally. Under conditions of perfect control, as when plants are grown in pots and flowered under glass, such points may be of importance, but under our variable outdoor conditions *they are not.* Special notes on chrysanthemum culture appeared in the June issue of this *Journal.*

Surplus and misplaced shoots of roses should be removed as they appear, and where fine blooms are desired the buds thinned. Newly-planted roses should be mulched, and a little care taken in the arrangement of the shoots, especially on standard specimens. An occasional dusting with flowers of sulphur will prevent mildew.

Carnations will be making their flowering growths, and will need attention in thinning and tying to stakes. Admission of light and air, and a more plentiful supply of nourishment for the shoots retained, are secured by thinning excessive growths on plants generally.

In reply to a query *re* striking daphne cuttings, it is not at all a certainty that cuttings of daphne will root except under conditions known to a few nurserymen only. Some of our most successful propagators often fail to strike cuttings of this plant. They require some shelter, such as a cold frame or bell glass, and regular attention for a long time. Lady cultivators manage occasionally to strike them, but the percentage rooted is very small. Cuttings of half-ripened wood, 4 inches in length, should be taken in early autumn and inserted in well-drained pots, filled with sandy peat, if available. These should be watered and placed under a

glass protection that will afford light and maintain a cool, moist atmosphere. Only sufficient moisture should be given to keep the cuttings fresh, and the glass should be wiped free from moisture each morning. Daphnes root readily from layers, tongued and inserted in sandy soil in spring.

Salvia "Bonfire" and other bedding plants may be planted.

Kitchen Garden.

Thinning and weeding growing crops, sowing seeds of such vegetables as well be required for use in autumn, planting out from former sowings, and, where necessary, watering young transplanted subjects are the most important items.

Tomatoes and other plants raised in frames should be planted out. In late districts protection against frost must be provided. For small gardens, bush marrow is the most suitable of that class of vegetable. The plants require little room, and produce several fruits if attended to with water and cultivation. Seeds of peas and French beans are better sown in drills, to allow the soil to be worked up to the plants later.

POTATO-GROWING AT WHITFIELD.

The following particulars of a crop of potatoes, grown on one of the Whitfield Closer Settlement blocks (Mr. A. Maconochie's), will show what can be done in that district with potatoes cultivated on up-to-date methods in soil, if anything, below the average quality of the flats on the estate.

Soil.—Light, red, sandy loam, shallow, with gravel bottom, and water-worn stones in patches on the surface. The land had previously been cultivated for two years, the first crop being green maize for dairy cows, and pumpkins. The last crop prior to the potatoes was oaten hay, upon the removal of which a sowing of rape was made, and fed off by cows.

Cultivation.—The land was ploughed, harrowed twice, and rolled in the spring. It was ploughed again on 6th January, when the potatoes were planted; this was about a month later than is usual in the district. The weeds were kept under, and a light hilling up made with the horse hoe. The sets were not cut, owing to the lateness of planting, and were placed 20 inches apart in the rows, and 34 inches between the rows, and 5 inches below the surface.

Manure.—Four cwt. of potato manure was used per acre, and was strewn in the furrow with the sets.

Yields.—The average yield from the three acres was 8 tons 18 cwt. per acre. One plot, 1-10th of an acre, of Beauty of Hebron variety, yielded at the rate of 15 tons per acre; another 1-10th of an acre, Brownell's Beauty, at the rate of 13 tons; and the same area of Peach Bloom and Pinkeye at the rate of 10 tons per acre. The total percentage of small potatoes was 6 per cent. The potatoes were free from disease of any kind, and were of good shape throughout. Mr. Maconochie carefully selects his seed, taking only well-shaped, good-sized tubers for seeding purposes. He is a firm believer in large sets, and does not cut his potatoes in a dry planting season. He also holds the theory that spreading the manures on the surface encourages the growth of weeds, and for this reason he prefers placing the manure in the furrow. The whole of the crop was sold to New South Wales buyers at £6 10s. per ton, delivered at Whitfield, the return being £58 per acre gross.

T.A.J.S.

THE ORCHARD.

James Lang, Harcourt.

The most pressing work for October will be the ploughing of the orchard, and putting the ground in a good state of tilth before the advent of the dry weather. The late heavy rains have left the ground in good condition for this work, which should be pushed on as rapidly as circumstances will permit. Where peas have been sown for green manuring, they should be fit for ploughing under early this month; do not delay this too long, as the ground soon gets hard, and it is then difficult to do the work satisfactorily. Roll the peas first with a heavy roller, and, if potash manure is to be applied, sow it after rolling with muriate or sulphate of potash at the rate of 2 cwt. per acre; then plough in, using a revolving coulter to cut the peas. Do not roll any more of the peas than can be ploughed in during the day, as they rise again during the night, and they do not roll so well again.

Grafting can still be done, provided the scions are in a backward state, but it should be completed as early in the month as possible.

Citrus fruits of all kinds may now be planted out; cut them well back when planted, and do not allow them to suffer from want of water. A good mulching of strawy manure placed around the trees will keep the soil moist for a long time.

Spraying will take up a good deal of time this month, so as to keep the various pests in check. Peaches will require constant attention for the black aphis, and should curl in the leaf appear spray at once with Bordeaux mixture. Apples and pears should be attended to for black spot; the standard formula is 6.4.40 (bluestone, 6 lbs.; quicklime, 4 lbs.; water, 40 gals.), but in the drier districts the quantity of water may be increased to 50 gallons. Spraying for codlin moth towards the end of the month will also require attention. The first spraying should be given when the petals of the flower have fallen, and before the calyx has closed; this is done in order that some of the poison should be deposited in the eye of the apple, ready for any grub that may try to enter through the eye. The Kedzie soda and arsenic solution and the arsenic of lime give as good results as any of the arsenical solutions.

DISEASES OF FARM ANIMALS.

S. S. Cameron, M.R.C.V.S., Chief Veterinary Officer.

(*Continued from Page 570.*)

Swine Fever.

Owing to want of space, the article on "Swine Fever," has been unavoidably held over until the next issue.—Editor.

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DISEASES OF FARM ANIMALS.

S. S. Cameron, M.R.C.V.S., Chief Veterinary Officer.

V.—NOTIFIABLE DISEASES UNDER THE "MILK AND DAIRY SUPERVISION ACT 1905."

Tuberculosis.

Of all diseases to which animal species are subject, tuberculosis is the most universal in the fullest and widest sense of the term. In man the dreaded "consumption" is a tuberculosis; in cattle the frequently-seen "piner," or "waster," is the victim of the same disease. It affects pigs, horses, and all other kinds of domestic animals, but to a more limited extent than cattle, the incidence of the disease in sheep, goats, donkeys, and dogs being comparatively rare. Fowls and other domesticated birds are especially subject to tuberculosis when placed in an infective environment, and it has even been found to affect fish. The disease is also universal in the sense that no country in the known world is free from it, and no disease affects so large a proportion of living beings. Sir Lyon Playfair, in an address at the opening of the Edinburgh University in 1886, gave utterance to a remark which, more than anything the author has ever otherwise heard, signalized the importance of the disease tuberculosis in its relationship to life. He said: "Of all factors on our present horizon of knowledge, the disease tuberculosis is the only one that can be regarded as reasonably likely to bring about the extermination of species."

Recognising all this, it is not wonderful that more has been written about this disease than about any other. The numerous phases which the study of the disease presents have been specialized on in innumerable volumes, to some or others of which the reader requiring anything more than the barest outline of knowledge of the disease will have to refer; for it cannot be expected that, in a work of this general character, space for anything more than a mere epitome of what is known about the disease can be afforded. The exigencies of space also forbid extended reference to the disease in animals other than cattle; but this is immaterial, seeing that its cause and nature are practically the same in all animals, as are the lesions it produces and its course, progress, and terminations.

DEFINITION.—Tuberculosis is a contagious, infectious, and infective disease, affecting man and nearly all the domesticated animals and birds, between most of which it is intercommunicable; caused by a specific germ (the *bacillus tuberculosis*); and characterized by the formation in various parts of the body of the anatomical lesion—tubercle, which, inflammatory in origin, undergoes various degenerative changes, such as caseation, calcification, and ulceration.

CAUSATION.—Tuberculosis is caused only by the introduction into the system, whether by inhalation, ingestion, or inoculation, of the *bacillus tuberculosis*.

This microbe was discovered to be the essential cause of the disease by Koch, in 1882. It is a rod-shaped bacillus, with rounded ends, and very minute, being about 1-12,000th to 1-20,000th of an inch long, and about 1-5th of this broad. Some of the bacilli are slightly curved, like a cucumber, and in others transparent spots, which may be spores, are seen. For detection of the bacillus by the microscope, the specimen containing it is best stained by what is known as the Ziehl-Neelsen process, the details of which may be found in any standard work on Bacteriology. It was for a long time thought that this method of staining differentiated the tubercle bacillus from all others; but later investigations have shown that certain other bacilli can also be stained by the same process. Of these, the leprosy, smegma, and timothy grass bacilli, and others found in cowdung, milk, and butter, are the most important.

The bacillus tuberculosis is non-motile and aerobic—that is, it needs air for its growth. It may be artificially cultivated on solidified blood serum, or on gelatine broth containing glycerine, and kept at a temperature of about blood-heat. On such media it grows slowly, the culture not reaching characteristic perfection for some weeks. Excepting this artificial method of development, the bacilli do not multiply outside a living body. They live outside the body for a long time, and retain their virulence for six months, or longer, in the dried state. As with other pathogenic organisms, they are quickly destroyed when in contact with putrefaction. The bacillus tuberculosis is not destroyed by the action of the digestive juices. Exposure to direct sunlight destroys it in a few hours, and shade daylight in about a fortnight. Boiling destroys it, as also does a moist heat of 170 deg. F. continued for an hour; but it is still infective in underdone cooked meat—that is, meat in which the redness of the juice is retained. It is not killed by freezing, nor does heavy salting do away with its virulence.

The mutability of the bacillus tuberculosis—that is, its capacity to become changed or modified in various ways—is now an important consideration, in that, if such a possibility is conceded, it appears to afford an explanation of the variant effect of the bacillus when removed from its natural habitat or environment. Just as it is known to vary in its shape, size, and other physical characters, so there is abundant evidence, which is set out in many recent works on the subject, that in different animals, and even in the same individual, the bacillus varies considerably in its pathogenesis,—*i.e.*, in its power of producing disease. With this borne in mind, and after exhaustive research and consideration, which need not be here detailed, the conclusion may be stated that the tuberculoses of different species are caused by the one bacillus tuberculosis, and that any apparent differences in effect on different animals are merely such as result from the modified environment, and will become less marked, as they do, the longer the opportunity for becoming accustomed to the modification of

environment is continued. In other words, the variant effect in disease-producing potency of the bacillus on different animals is merely a question of slow adaptability or habituation to new conditions. It was doubtless the lack of recognition of this which led to Koch's blundering assertion, in 1901, that human and bovine tuberculosis were caused by different bacilli, the erroneousness of which was overwhelmingly proved by the British Royal Commission appointed to investigate the matter, and by hundreds of private investigators, whose observations and conclusions are so closely packed in the pages of the scientific literature of the time.

AUXILIARY CAUSATION—*Heredity.*—In dealing with heredity as a causative factor in disease production, the question of the hereditary character of tuberculosis was adverted to at some length. It was there stated that, while the disease itself was not transmitted from parent to offspring, the predisposition to it, or a vulnerability of the offspring to the attack of the disease, was so transmitted. The importance even of hereditary predisposition is modified somewhat by the fact that the offspring of tuberculous animals are born into a tuberculous environment, and are therefore quickly exposed to infection, to which their susceptibility to tuberculosis ought, perhaps, to be more largely credited, rather than to hereditary predisposition. Bang's world-famous experiments seem to prove this. He was able to rear perfectly sound cattle from cows far advanced in the disease by the simple precaution of removing the calf, immediately it was dropped, to uninfected surroundings at a distance, feeding it on milk from sound cows, and preventing contact throughout with other than healthy cattle.

Breed.—It is strongly held by some that certain breeds of cattle are more subject to tuberculosis than others; but an extended experience of the disease in widely separated districts forces the conclusion that, other things being equal, the difference in degree of vulnerability of the different cattle breeds is slight, if indeed it exists at all. Heavy milkers of any breed are more prone to attack on account of the continuous drain of milking on their system and constitution, and if one breed is a deeper milking breed than another then the proportion of tuberculosis might be expected to be greater, but this is not a question of breed, but of nutrition. The fact is that the range of experience of most observers is confined to definite districts, and because Shorthorns or Jerseys are found to be more frequently tuberculous than any other breeds in districts where these breeds predominate, an incomplete and erroneous conclusion may be come to. An instance of this may be given. In 1902, it was announced in the *Journal of the Department of Agriculture* that Jerseys were more particularly subject to tuberculosis than other breeds of cattle. The statement was challenged by Jersey breeders, and it turned out that the main basis on which it was made was the fact that by far the largest number of tuberculous cows killed at the kennels of the Melbourne Hunt Club were Jerseys. These kennels are situated in a district in which there were more Jersey cattle to the square mile than in any other area in the Commonwealth, as might be expected from the fact that two of the leading stud Jersey herds of Australia were located in the vicinity.

Environment.—The keeping of cattle in close contact with each other tends to the more rapid spread of the disease through a herd, and consequently the prevalence of the disease is found to be greatest in herds that are confined in byres for a considerable proportion of their time. On this point, and in so far as the spread of the disease in Australia is concerned, it is opportune to reproduce the following remarks by the author in an address before the Australasian Association for the Advancement

of Science, at Brisbane, published in the journal of the Association for 1895:—"It is desired to take this opportunity to publicly correct a false impression that obtains in some quarters to the effect that cattle kept in a semi-wild state in the Australian bush are immune to the disease. Knowing that tuberculosis is to a certain extent a disease of domestication, spreading readily by close cohabitation, a superficial consideration would seem to support such an impression. But experience of the conditions under which the cattle are bred and reared shows that there are factors obtaining in Australia which predispose to the prevalence of the disease just as much as do the close cohabitation and pampered treatment of cattle in byres in the old world. First of all there is an equal vulnerability to the disease inherited, here as in England, from pure-bred and diseased sires and dams, either imported or the progeny of imported stock. Then, although for the most part cattle are never housed, they always, even when in large mobs, have favourite camping-grounds on which they congregate at night, and which become contaminated with infected droppings and discharges. The stagnant waterholes in the vicinity of these camping-grounds may at any time become contaminated, and facilitate the spread of the disease. A third factor in the spread of the disease in the past has been the indiscriminate way in which virus has been obtained to inoculate for the prevention of pleuro-pneumonia. Tuberculous animals are very likely to become affected with pleuro-pneumonia, and stockowners (thousands of whom inoculate their own cattle) in many cases are as likely to obtain virus from a tuberculous animal as not. Most important of all, however, is the fact that at least 90 per cent. of all the cattle bred in Australia are not slaughtered until they have arrived at or gone far beyond maturity. The females are kept for breeding until eight and nine years old. Bullocks are not slaughtered until at least four years old, the average age being six. When it is remembered that tuberculosis in bovines is mostly a disease of maturity or old age, it will be seen that the opportunities for its spread are very great, as each animal that becomes affected as age increases acts as a fresh centre from which the disease is communicated. Abattoir statistics indorse this, as it is found that the disease is most common by far in bullocks—especially those from Queensland—up to seven, eight, and nine years old, and in old dairy cows."

Age.—The fact that tuberculosis is in cattle a disease of old age for the most part is an important one. It is not found in one-fifth per cent. of heifers, and dairy herds in which the practice of culling cows after the fourth or fifth calving is followed can so be kept practically free from the disease.

Other factors that may act as auxiliary causes of the disease are insufficient or improper food, starvation, too early breeding, and in-breeding, in so far as these impair the constitution, and in fact any of the many conditions referred to in the chapter on Causation of Disease which favour diminished resistance to the invasion of disease.

MODES OF INFECTION.—Without setting forth speculative ideas as to the means whereby the disease may be conveyed to an animal, it may be said that the following modes of infection have been definitely ascertained:—(*a*) The ingestion of milk containing tubercle bacilli, this being a common mode of infection of young animals and of pigs. (*b*) The inhalation of particles or matter (dust) containing tubercle bacilli exhaled or emitted in the discharges of affected animals, and dried by exposure. (*c*) The swallowing of sputum, phlegm, or discharges from affected

animals, as when a feed-box or manger has been contaminated through previous use by a coughing cow.

Recent researches would appear to indicate the likelihood of tubercle bacilli remaining dormant in the system for months, or even years, before a definite tubercle lesion is set up. If this be so, it may be that many cows which only develop tubercle late in life have actually become infected during calfhood.

PREVALENCE.—Until recent years the question of the extent to which the disease prevailed was very much a matter of guesswork. Estimates were mainly based on abattoir statistics, and the variation of these was notorious. It was accounted for largely by the difference in rigidity of inspection. In fact, the percentage of tuberculosis found to exist in different countries was in ratio to the thoroughness with which inspections were carried out. Denmark's high prevalence of 16 per cent. some years ago was testimony to the thoroughness with which every diseased cow was ferreted out. In other countries the estimate of 2 per cent. given under lay inspection was increased to 12, 14, and even 26 per cent. on the work being intrusted to trained veterinarians, who did not increase the prevalence of the disease, but found it where it had been previously, either carelessly or ignorantly, overlooked. It was a shock to England to find from the records of examination of all cattle killed under the Pleuro-pneumonia Slaughter Order of 1892 that the percentage prevalence, though varying in different counties (Edinburgh, 5.75 per cent.; Durham, 18.7 per cent.; Midlothian, 20 per cent.; Yorkshire, 22.8 per cent.; and London, 25 per cent.) was so high—the average being over 5 per cent. of all adult cattle in Great Britain and 20 per cent. of all milch cows kept in cities.

In Australia the earliest mention of tuberculosis that the author has come across is in connexion with the *post mortem* examination of pleuro-pneumonia cattle during the first outbreak in 1859. The conditions described by Mr. Miscamble, M.R.C.V.S., in an animal supposed to have recovered from pleuro-pneumonia leaves no doubt that the animal was affected with tubercle. He says: "There were tubercle in several clusters lining both sides of the chest, and in the superior mediastinum a large tumor full of curdled lymph which seemed to have existed for a considerable time, as the walls of the abscess were quite tough." Speaking on the same specimen, Mr. Pottie, M.R.C.V.S., a then recent arrival from Scotland, said—"Besides pleuro-pneumonia there was another disease in them, viz., tuberculosis." (*Argus*, 17th September, 1859.)

Yet the prevalence of the disease was strenuously denied until in 1884 the Board of Inquiry on Tuberculosis in Cattle in Victoria, having had careful records kept at the Melbourne City Abattoirs, reported that "over 7 per cent. of all cattle slaughtered for the meat supply of Melbourne are tuberculous in some degree." Statistics collected by the Board during the inquiry showed that "for the half-year ending December, 1884, of 16,780 cattle slaughtered, 7.1 per cent. were affected," so that the first-mentioned conclusion was not based on scanty numbers. In spite of the revelation of this Board of Inquiry, an almost incomprehensible perversion of facts in regard to the existence of the disease seems to have been persisted in. As late as 1895 the official estimate of the prevalence of tuberculosis in cattle in Victoria was 1 in 300, or .3 per cent.—this in face of the fact that at the Melbourne City Abattoirs during the previous year, 1894, of 17,681 cattle slaughtered during six months, 169 were condemned as unfit for consumption on account of tuberculosis. This is a proportion of 1 in 104.6, practically 1 per cent., and takes into account only those

condemned; not those, always the greater proportion, affected to a degree not considered as rendering the carcasses unfit for human consumption.

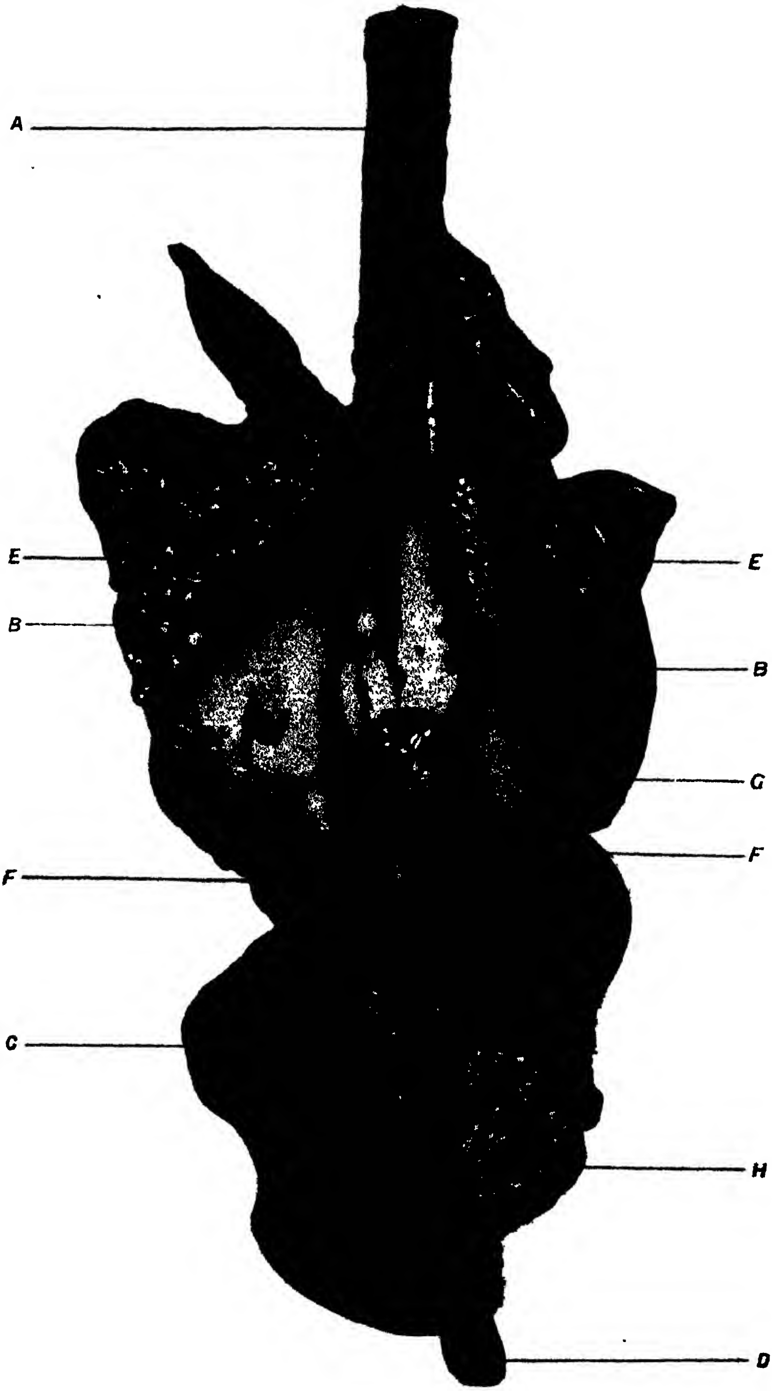
Amongst dairy cattle in Australia reliable statistics are not plentiful. The most reliable are those based on a diagnosis as furnished by the tuberculin test. Such are those published in a report by the author to the Board of Public Health, Victoria, in 1889. A number of milking herds of different breeds were tested in widely-separated parts of the State, and the aggregate totals showed a 9 per cent. prevalence. The report states: "The animals comprising these herds were mostly young cows, or cows in their prime, and above the average of dairy cattle in breeding, in condition, and milking qualities, so that there is likelihood that the proportion of tuberculous animals found in the herds tested, viz., 9 per cent., is not in excess of that for dairy cows in the Colony at large."

Since then, however, the impression must be recorded that there has been a not inconsiderable diminution in the prevalence of the disease. The amount of tuberculosis met with at the abattoirs has certainly diminished, and a corresponding diminution amongst dairy herds may not unreasonably be counted on, so that now it may be asserted that the all-round prevalence does not much exceed 5 per cent. One of the factors accounting for this diminution has been the period of drought through which the continent has passed. During this time it became a question of the "survival of the fittest," and hundreds of weakly and diseased animals were carried off. The efforts of the Stock Departments of the different States in continually seizing and destroying tuberculous cattle and so removing *foci* of infection must also have played a considerable part in diminishing the prevalence of the disease.

PATHOLOGY.—When virulent tubercle bacilli become deposited in an organ or tissue of the body suitable for their development, they, by their irritation, set up a mild inflammation and increased growth of cells in the immediate vicinity, while leucocytes emigrate from the surrounding capillaries. The cells are distinctive in character, a few being large multi-neucleated and branched cells called "giant" cells, and the remainder, much more numerous, are epithelioid and lymphoid cells. Tubercle bacilli are frequently seen in the giant cells or their vicinity on microscopic examination. The whole constitutes a rounded mass not larger than a pin's head or millet seed, grey in colour, and non-vascular, called a "tubercle." Many of these tubercles are formed in the vicinity of the bacilliary infection, and by their coalescence into masses there are formed the larger nodules, still called tubercles, though varying greatly in size, which constitute the characteristic lesion of tuberculosis. A distinct feature of these nodular growths is their tendency to undergo a caseous degeneration, commencing at the centre of the nodule but ultimately involving the whole mass, which then consists of a mass of structureless and granular *débris* with fat and mineral salts, usually a dirty yellow in colour, and varying in consistency from that of a slimy, thick cream to a soft, ripe cheese; hence the name given to the process, *caseation*. Sometimes a further degenerative change takes place, viz., *calcification*, in which the deposition of mineral salts results in the nodule taking on cretaceous properties, it being hard and gritty to the touch when cut.

In other cases there becomes developed in the nodule, especially in the neighbourhood of its wall, a quantity of fibrous tissue, giving it a solid and leathery consistency. This fibroid degeneration usually occurs in the

DESCRIPTION OF PLATE.—A. Trachea or windpipe. B. Normal lung tissue. C. Normal liver. D. Gall bladder. E and G. Stage of caseation. F. Nodule forming. H. Stage of calcification.



LUNGS AND LIVER OF COW AFFECTED WITH TUBERCULOSIS.

tubercular growths on serous membranes, the nodules becoming pearly or stony in colour, and giving rise to the condition known as "grapes." On section of these bunches of nodules many of them will be found to be caseous, although the majority are fibrous. Each of these three conditions of degeneration is indicative of a varying chronicity of the lesion, and therefore of its age; while the grey tubercle, undegenerated, is always of recent formation.

The *encapsulation* of tuberculous abscesses often occurs by the formation round them of a thin but strong wall of fibrous tissue, whereby the contents are cut off from the circulation, and may remain passive for a long period. The contents often dry up and become mummified, in which case the walls may collapse and heal together, forming a mass of scar tissue which gradually contracts and may become almost obliterated. This is what happens when the "cure" of a local focus of tuberculosis in the lungs or elsewhere takes place.

The lesions of tuberculosis may exist in any part of the body, but bone, muscle, and nervous tissue are not often the seat of the disease. In a long series of *post mortem* examinations, of which notes were taken by the author, tuberculous lesions were found in the following organs and tissues, set down in the order of frequency:—Lungs (and pleura), liver, lymphatic glands, intestines, mesentery and peritoneum, spleen, udder, uterus, kidneys, ovaries, and pericardium. The different groups of lymphatic glands were found to be most frequently affected in the following order:—Bronchial and mediastinal, mesenteric, post-pharyngeal, sublumbar, hepatic and mammary. In pigs the post-pharyngeal lymphatics are affected more frequently than any other.

Local and General Tuberculosis.—As regards the primary lesions of tuberculosis, and the spread of the disease to different parts of the body, consideration may be given under three heads—

1. *Primary Localized Tuberculosis*, in which the lesions are confined to one organ or to one organ and its immediate efferent lymphatic glands.
2. *Secondary Localized Tuberculosis*, in which lesions also exist in an organ or part remote from the seat of the primary focus, but connected with it by lymphatic vessels (efferents from the primary focus) by means of which the infection has been conveyed.
3. *Generalized Tuberculosis*, in which lesions exist in organs and parts remote from each other, and unconnected directly by lymphatic vessels, the infection having been spread from primary or secondary foci by means of the general blood circulation.

Primary Localized Tuberculosis occurs as a result of infection from the exterior of the body into some part other than the blood stream. Familiar instances are (*a*) lung lesions caused by the inhalation of bacilli and their absorption through the wall of the air cells into the lung tissue; (*b*) intestinal or mesenteric lesions through the ingestion of bacilli with the food and their absorption into the wall of the intestine or the mesenteric lymphatic glands; and (*c*) pharyngeal lesions resulting from the action of bacilli in the food or in mucus from the lungs deposited on the tonsils and absorbed through the tonsilar follicles into the lymphatic vessels of the post-pharyngeal lymphatic glands. This is the most frequent track of infection in pigs.

It does not follow, however, that lesions always occur in the tissues or gland which the invading bacilli first reach. They may, and many times do, pass on by the lymph stream from the tissues in which they are first deposited to lymphatic glands beyond, before becoming arrested and assuming their disease-producing activities. Hence tuberculosis of the bronchial glands is often found as a primary lesion without the lung tissue or other part of the body having been invaded. Carcasses affected with primary localized tuberculosis are not condemned wholly as unfit for human consumption. The organ or tissues in which the disease exists together with the tissues in which their efferent lymphatic vessels ramify are alone likely to be dangerous.

Secondary Localized Tuberculosis. — This occurs when bacilli from existing lesions are conveyed by means of the lymph stream to a remote gland or organ in which they become deposited and set up the disease. At times glands or organs *en route* may be passed through without tubercle being set up. As instances, may be taken secondary infection of the mediastinal glands or of the lungs and pleura from foci in the liver—in which case the bacilli would pass respectively along the lymph vessels of the vena cava into the mediastinal glands and thence into the pleural cavity or lungs.

To determine definitely that the trouble is a secondary localization when lesions are found remotely situated requires a considerable and accurate knowledge of the anatomy and relationship of lymphatic vessels and glands, hence the necessity of such knowledge being possessed by meat inspectors so that the public health may be conserved without unwarranted loss to butchers.

Generalized Tuberculosis.—This has occurred whenever there are two or more seats of disease which are unconnected by lymphatic vessels*; that is, when the bacilli have entered the "general" blood stream and are spread by it. The word general is given the emphasis of inverted commas because the presence of bacilli in some parts of the circulation is not *necessarily* followed by generalization. In the portal circulation they are likely to be arrested in the liver; and again, when emptied out of the thoracic duct into the blood stream at the jugular vein whence they pass through the right heart they may be arrested in the lungs; but generalization is likely to soon follow because of the numerous foci so created in the liver and lungs respectively.

In generalized tuberculosis the carcass is wholly condemned as unfit for human consumption.

Statistics gathered at different times show that in about 14 per cent. of all cattle affected with tuberculosis the disease is generalized.

MEAT INSPECTION AND TUBERCULOSIS.—On the subject of the condemnation of the meat or carcasses of tuberculous animals, in addition to what has been already said, it may be well to quote the resolutions of the Inter-State Conference of Government Veterinary Surgeons (Messrs. W. C. Quinnell, M.R.C.V.S., Queensland; Ed. Stanley, F.R.C.V.S., New South Wales; and S. S. Cameron, M.R.C.V.S., Victoria), held at Melbourne in 1902:—

Resolution 1.—"That when tuberculosis exists in only one organ, including the lymphatic glands receiving lymph from that organ, or in only one distinct group of lymphatic glands, or in only one other isolated

* This statement requires to be qualified in the case of two or more separate lesions being the result of distinct primary inoculation.—S.S.C.

situation, the part of the animal only which is so affected should be condemned; except when such local tuberculosis is concomitant with emaciation, in which case the whole carcass should be condemned."

Resolution 2.—"That when tuberculosis exists in two or more places (organs, glands, membranes or tissues) not directly connected by lymphatic vessels, the whole carcass should be condemned."

SYMPTOMS.—Tuberculosis develops slowly and insidiously. For this reason, as also because of the variety of vital organs and tissues which it may attack, the symptoms are, in the earlier stages, at all events, very indefinite and variable. Except in the case of lung invasion, it is not until the disease has commenced to interfere with nutrition that the symptoms are sufficiently pronounced to attract attention.

When occurring in the lungs, there will be an occasional short, dry, weak cough, or "hoose," which is especially provoked and accompanied by blowing or respiratory distress on the cow being driven into the shed for the morning milking or when it is inordinately hustled at other times. There may be a dryness and scurfiness of the coat, with a hide-bound skin, and the appetite may be capricious. If the disease happens to be in that region of the lungs which can be effectively sounded, *percussion* may reveal dullness in patches, corresponding to the diseased areas in the lungs. *Auscultation* is, however, more satisfactory as a means of physical examination of the chest. Creaking and wheezing sounds are heard over circumscribed and isolated areas; and when there is a grapy condition of the pleura the abnormal pleuritic sounds confuse or completely cover up normal lung sounds. It is a good plan to cover over the mouth and nose with a bag when sounding the chest, so as to induce heavy, deep breathing, by which the sounds are rendered clearer.

In tuberculosis of the intestines and liver, the former of which frequently attacks young, immature cattle,there may be fœtid diarrhœa, intermittent in character, but very persistent.

When there is extensive invasion of the lymphatic glands, some of those superficially situated are likely to be involved, and their enlargement may be felt under the skin, in the front region of the chest, the flank, and the angle of the jaw and neck (post-pharyngeal lymphatic glands). In the latter case the enlargement is often accompanied by a more or less pronounced snore in the breathing. Tuberculosis of the glands in this region may usually be distinguished from actinomycosis (lumpy jaw) by the fact that the swelling is moveable, and fluctuates on pressure, the actinomycotic tumour being usually hard and firmly fixed to the jaw-bone.

The disease progresses slowly in most cases, and it may be many months, or even years, from the time of infection before serious inroads on the general health are manifested. As the disease advances, the cough will become more frequent and distressing, the cow ceases to thrive well even on good food, the coat loses its gloss, the hair is dry, harsh, and staring, the skin becomes tight, the eyes may be sunken, but at times they stand out abnormally and are glassy looking, there is often a discharge of tears, the cow stands with the back arched and belly tucked up, although in some cases there is a tympanitic enlargement (hoven) of the abdomen after feeding, and altogether the cow presents a dejected and sorrowful appearance. The appetite becomes capricious, and there may be attacks of diarrhœa at intervals. The milking function is not usually diminished, but the milk is thin and watery, and deficient in butter fat. The temperature, if taken daily, will be found to be erratic; sometimes it is raised

a degree or more, and sometimes it is sub-normal. Then comes the stage of emaciation, when the animal wastes rapidly, almost visibly, until it is miserably thin and weak. The skin and mucous membranes become blanched; the cough is more markedly painful and paroxysmal, and is easily induced by pressure or a slight blow on the ribs; the temperature is now always high, ranging from 103 degrees to 105 degrees F., and the animal gradually sinks into a condition of marasmus, so helpless and complete that death quickly ends the scene.

DIAGNOSIS OF TUBERCULOSIS.—Considering that most of the symptoms detailed are such as may occur in any slow wasting disease, and that none of them are peculiar to tuberculosis, it follows that accurate diagnosis of the disease from objective symptoms alone is a somewhat difficult matter, and, in point of fact, is seldom accomplished in the early stages, except there is a history of tuberculosis in the herd. Consequently, such adventitious aids to diagnosis as microscopic examination, artificial culture, Arloing's agglutination test, experimental inoculation, and the tuberculin test, are practised. The value of all but the last of these is largely discounted by the length of time they involve, and other drawbacks, and in practical working the tuberculin test is the best aid to rely on, either for confirming a diagnosis or for detecting the presence of tuberculosis where no symptoms are discernible.

THE TUBERCULIN TEST.—Tuberculin is a sterilized glycerine extract of the culture of the *bacillus tuberculosis.* It contains the products of the growth of the bacilli, and, when injected into a tuberculous animal, there results a passing fever, with a corresponding rise of temperature. This does not occur when the tuberculin is injected into a non-tuberculous animal, but it is practically constant in tuberculous animals, perhaps the only exception being in the case of animals very extensively affected with the disease, in which case the system seems to be so highly charged with tuberculin already that there is no response to the small additional amount constituting the usual dose for injection. Conversely, in animals only slightly affected the rise of temperature is often very high. These peculiarities of the effect of tuberculin—*i.e.*, the fact that the rise of temperature is frequently in inverse ratio to the extensiveness of the disease—may be taken in some measure as a guide in estimating whether the disease is generalized or not. Tuberculin properly applied, and its action properly interpreted, may be relied on almost absolutely to manifest the existence of tuberculosis; but, except in so far as a guide is furnished by the peculiarities mentioned, it gives no idea as to the stage of disease the animal is in.

Technique of the Test.—An impression prevails that the application of the tuberculin test is a simple matter. While the routine procedure may appear simple, there is a great liability to error at almost every stage of the process, except the most scrupulous and methodical care is exercised. The truth of this is so strongly enforced by extended experience that there need be no hesitation in declaring that the application of the test ought not to be intrusted to other than qualified veterinary surgeons, who have had special training and practice at the work. In other hands failure is bound to result, either in the condemning of healthy cows or the passing of diseased ones, and it is to the fact that operators have not always been sufficiently experienced or careful that the test has at times been discredited.

Before commencing the test the operator must be satisfied that the cows to be treated are—

(*a*) Not suffering from any acute disease or febrile symptoms, wounds, tumours, or local inflammation, such as mammitis;

(*b*) Not within three days of the "bulling" period, either before or after;

(*c*) Not within three weeks of calving;

(*d*) Over one week calved, and that they have cleansed properly—else a rise of temperature cannot be relied on, inasmuch as it may occur in association with one or other of the conditions mentioned, independent of tuberculin injection. The operator must be provided with a book in which are blank temperature charts, one for the use of each cow. On the chart should be entered the name, colour, brands, and age of the cow, whether in calf or not, and, if so, how long gone, and any other particulars that may be noted at the first examination of the cow which are likely to have a bearing on the test. Attached is a specimen copy of the chart regularly used by the author:—

No. 1.—"Creamy," 5yrs., Brown and White, V Right Rump, in Calf 3 Months.

Dose.	Before Injection.			After Injection.						Rise.	
8 p.m.	5 p.m.	8 p.m.	Mean.	6 a.m.	8 a.m.	11 a.m.	12 p.m.	2 p.m.	Mean.	Highest.	Mean.
105	...	...	...	...	...	·7	·7	...	...	3·9	
104	..	...	...	...	·8	...	...	·8	·9	..	3 1
103	...	...	...	·8							
102	..	·1									
101	·5	...	·8								
100											

The temperature of each cow must be taken at least twice, at intervals of not less than two hours, before the injection of tuberculin. If neither record is obviously abnormal, the mean of the two may be taken as the standard temperature from which to calculate a reaction rise. The most suitable time for the first temperature is prior to the evening milking, when the cows are bailed up as ordinarily in their customary stalls. They will then be more likely to show an ordinary temperature than if taken up at an unusual time. The temperatures must be taken in definite order, and the same order must be maintained for the injection and the subsequent temperatures. The thermometers used should be numbered, marked, and tested against each other on one cow prior to use, any variation being allowed for on the chart. As far as possible, the same thermometer should be used for the same cows throughout the test.

It is well to use one make of tuberculin continuously, as the different makes are standardized differently, and the calculation of altered dosage and effect is confusing. Of Koch's tuberculin about five drops is the dose for a medium-sized cow in fair condition, and this dose may be varied according to age, size, and condition. For old, emaciated cows, suspected to be tuberculous, double doses may be used. The dose requires to be diluted with five times its bulk of a .5 per cent. solution of carbolic acid in distilled water, bringing the amount to be injected up to an average of thirty drops, or half a dram. In testing a herd, it is more expeditious and convenient to make the dilution for a number of cows at one time.

Pour the contents of the Koch's phial into a small graduated measure-glass, and measure it. Then pour it into a larger graduated measure-glass, and add five times the quantity of diluting fluid. The syringe may be filled from this by drawing up the required dose. All air should be excluded from the syringe by holding it needle upwards, and pressing the piston until bubbles cease. An ordinary veterinary hypodermic syringe is used, with short stout needles, of which half-a-dozen or more extra ones need to be always provided in case of breakage. Socketed needles take less time to adjust than those with a screwed joint, and are much to be preferred. The injection is made in the loose skin immediately behind the elbow on the right side, a fold of the skin being gripped with the two fore-fingers and thumb of the left hand, so as to form a vertical fold lengthways, into which the needle of the syringe is plunged with the right hand, care being taken that the point of the needle does not protrude through the skin. On the piston being forced in, the needle is removed, the fold of skin loosened, and the little pocket of fluid gently massaged until it commences to disperse. As far as possible aseptic precautions should be observed throughout the test. At any rate, prior to injection the hair and skin at the seat of injection must be washed with a solution of corrosive sublimate, and between each injection the needle and syringe need to be rendered sterile. This is best done by first flushing in a half per cent. solution of carbolic, then in absolute alcohol, and finally in carbolic solution again.

After injection, the cows must be treated as ordinarily in every way, being fed, watered, and the like, as usual, and brought up to milk at the usual time next morning. This will be about the time—ten hours after injection—when it is usual to commence taking the reaction temperatures. This is done by taking the temperature in the same order and under the same conditions as before, at least three times, at intervals of two hours. The non-reacting cows will usually have a lower temperature in the morning. If by the fourteenth hour (third temperature) no tendency to increase of temperature is observable, the animal may be regarded as free from tuberculosis. In tuberculous animals there is usually a slight rise by the tenth hour, which increases up till the sixteenth or eighteenth hour, and then gradually declines, and has passed away by the twenty-fourth hour. A typical reaction temperature chart shows a gradual rise to a maximum, and a corresponding gradual fall, producing what is known as a "reaction curve" (see specimen chart). During the taking of the reaction temperatures each cow must be keenly observed, to catch any unusual symptoms or attitude, such as bellowing, excitability, inappetence, diminution of milk, intermittent and jerky urination, diarrhœa, staring coat, nasal and lachrymal discharge. All or any of these must be carefully noted, and given due weight when interpreting a reaction. A rise of two or more degrees Fahr. over the mean temperature prior to injection is held to constitute a reaction, provided that—(*a*) the prior mean temperature has not been composed of widely dissimilar records, (*b*) that there is an absence of any other recognisable cause, and (*c*) the rise has been consistently maintained throughout the usual period. Given these conditions, all is plain sailing, and a diagnosis of tuberculosis may be confidently ventured. It is in the cases where there is variation from these conditions, such as a continuous or single high temperature before injection, an unevenness of the reaction curve, and the like, that the discrimination and judgment of the examiner is taxed in interpreting the temperature records.

TABULATED REPORT CONCERNING TUBERCULIN TEST.

Cow.	Description.	Age.	Temperature before Injection.			Temperature after Injection				Rise.		Abnormal *post-mortem* Appearances.	
			6 hrs.	½ hr.	Mean.	12 hrs.	16 hrs.	20 hrs.	Mean	Highest.	Mean.	Tubercular.	Other.
No. 1 ..	Prime milking condition; sleek and fat	7 years	101·5	101·2	101·3	104·5	104·2	104·5	104·4	3·2	3·1	Large coalescing tubercular abscesses throughout liver substance	Hydatid cysts in lungs and liver; flukes in liver
No. 2 ..	Prime milking condition; sleek and fat	aged	102·5	102·0	102·3	105·7	105·8	105·8	105·8	3·5	3·5	Extensive tuberculosis of intestines and mesentery; a few tubercular nodules in both lungs	A few hydatid cysts in liver
No. 3	Fair milking condition; slightly hide-bound, with staring coat	6 years	103·6	101·6	102·6	105·2	102·6	103·1	103·6	2·6	1·0	Caseous tubercular nodules throughout liver and intestines	Flukes in liver; left lung hepatized in in patches
No. 4 .	Fair condition; hide-bound coat	aged	101·6	101·0	101·3	104·8	105·7	105·7	105·4	4·4	4·1	Tubercular abscesses and nodules in both lungs; walls of large intestines (cœcum and colon) studded with miliary tubercles; caseous tubercles in liver	Slight pleuritic adhesion of left lung
No. 5 ..	Prime milking condition; sleek and fat	aged	101·3	101·4	101·4	102·0	104·5	104·2	103·6	3·1	2·2	Small tubercular abscesses and nodules in both lungs, some grey, others caseous	Nil

Occasionally what is known as a local reaction to tuberculin may be observed—that is, in the case of tuberculosis of external lymphatic glands or of the udder, an inflammatory condition, local to the diseased part, is induced during the period of tuberculin influence. Hence the necessity to examine the udders and external glands of all cows showing signs of reacting, and also of making a thorough physical examination of the chest.

It should be mentioned that, by an extensive set of tests carried out by the author in conjunction with Mr. H. W. Potts, F.C.S., &c., Principal of the Hawkesbury Agricultural College, New South Wales, at the Leongatha Labour Colony, it was clearly demonstrated that tuberculin injection interfered in no way with the milking function in healthy cattle; neither in quantity of milk nor in butter-fat value could any variation be detected.

The preceding table, giving general description, temperature, and *post-mortem* appearances of the reacting animals in a herd is published as a type for reference and guidance.

UDDER TUBERCULOSIS.

Mammary Tuberculosis, or tuberculosis of the udder is almost always secondary to lesions in other parts, and it seldom occurs except when the disease is generalized. The author has, however, come across at least four cases in which the most careful examination failed to reveal the slightest trace of the disease in any other part of the body; and other cases also in which, by the localization of the lesions in other organs, and their apparent incipiency as evidenced by the slightness of the degenerative process, the presumption was forced that the udder lesions had been primary. In three of the four cases referred to the mammary lymphatic glands only were diseased, but in the fourth there were numerous caseous and coalesced tubercles throughout the gland tissue of the quarter; the mucous lining of some of the milk ducts had on it yellow caseating granulations, and the interstitial fibrous tissue in parts was indurated. One of the three cases in which the mammary lymphatic glands alone were affected was a heifer calf, twelve weeks old, that had been used for the cultivation of calf lymph for vaccination. As might be expected at this age, the undeveloped gland was practically devoid of mammary tissue, and consisted merely of a mass of fat. Each of the supra-mammary lymphatic glands was enlarged, and had undergone caseous degeneration.* The cue as to the method of infection was given by the condition of the umbilicus or navel, which had not properly healed, and which was at the time of slaughter still somewhat ulcerated. In view of the fact that the afferent vessels of the mammary lymphatic glands drain lymph from the flank walls of the abdomen and umbilical region, the deduction that the disease was conveyed from tubercle-infected litter or bedding through the unhealed umbilicus, and thence by the lymphatic vessels to the mammary lymphatic glands, appears feasible. In the *Revue Générale de Médecine Veterinaire* for March, 1903, there is a case of primary tuberculosis of a milking cow recorded by Conté, who puts forward the view that fragments of straw contaminated with tubercle bacilli may have entered the teat duct, and thus caused infection of the gland. In support of this view, he states that the owner had for some time been using as litter straw taken from palliasses removed from certain hospitals, and concludes that "the straw had probably been soiled by discharges from tuberculous patients." Such a method of infection could not have been possible in the case of the calf now being

* The specimen is preserved in the museum of the Board of Public Health, Melbourne.—S.S.C.

recorded, for the undeveloped gland was devoid of mammary tissue, and the teats at such an early period are practically impervious. A more likely explanation of the primary cases than that offered by Conté would be infection through wounds in the skin of the udder from tubercle-contaminated litter, or in the case of a consumptive milker moistening his hands with his sputum for the milking of a cow with chapped teats.

Udder tuberculosis is most often confined to one or both hind quarters of the udder, the fore ones being less frequently attacked. The differentiation between this condition and an ordinary inflammation or "blind" quarter is important, but not always easy to decide on. In the first place, it is seldom that young cattle have tuberculous udders, so that an udder complaint in cows before the sixth calf may usually be dismissed as non-tubercular. In tuberculosis, there is usually no diminution of milk secretion—in fact, it may be slightly increased, but is thin and watery, and the quarter tends to gradually enlarge, the swelling being firm and painless; whereas in ordinary inflammation the milk becomes curdled or ceases to be formed, and the quarter shrivels after the subsidence of the acute inflammation. On very careful manipulation, and comparison with the other quarters, a nodulated or knotted condition of the substance of the quarter may be felt. Sometimes a soft patch, indicative of a caseous or purulent abscess, may also be detected, especially if it is near the surface. To confirm suspicion, microscopic and bacteriological examination of the milk for bacilli is necessary. Other plans include the extraction of a little piece of tissue from the quarter by means of a "harpooning" instrument, or the drawing out of a little matter from a suspected abscess with an aspirating syringe—the material in both cases to be examined microscopically and bacteriologically.

The proportion of tuberculous cattle that are affected in the udder is from 2 to 3 per cent. In a series of *post-mortem* examinations of tuberculous cattle made by the author, over 5 per cent. had udder tuberculosis, but this is unusual. The milk from a tuberculous udder contains tubercle bacilli in most cases, and is infective to mammals partaking of it, particularly the young. Piglings are particularly prone to contract tubercle in this way, and many authentic cases are on record of tuberculosis in children being caused by drinking such milk.

On the question as to whether the milk of tuberculous cows with healthy udders is infective or not, the majority of investigators have concluded that it is not. On the other hand, the investigations of a not unimportant minority, led by Bollinger, who was successful in 55 per cent. of cases in producing tuberculosis in animals by ingestion and inoculation of the milk of tuberculous cows having healthy udders, affirm that such milk may contain bacilli and be infective. The author has elsewhere* reported on an investigation by him of this phase of the subject, which in a large measure would seem to support the conclusions of the minority.

* Report to the Board of Public Health on, 1901.

THE FUNCTION OF SILICA IN THE NUTRITION OF CEREALS.

Alfred J. Ewart, D.Sc., Ph.D., F.L.S., Government Botanist.

The fact that cereals and other grasses contain large quantities of silica is well known, but, although it may amount to 50, or even 80, per

cent. of the ash left after burning, we know little or nothing as to its function in the economy of the plant. It was at one time suggested that it conferred increased strength and rigidity upon the stems of cereals, and that the laying of crops was due to the absence or deficiency of silica in their haulms. This suggestion is, however, incorrect, and, as a matter of fact, laid crops may contain more silica than normal ones. The presence of silica does not seem to protect grain against the ravages of various parasites and destructive fungi, but does, on the other hand, appear to economize the consumption of mineral food by the plants. Evidence of its importance is afforded by the fact that when oats were grown in artificial nutrient solutions deprived of silica, the formation of grain was delayed, and the grain was deficient in quality and quantity. A recent publication (by A. D. Hall and C. D. Morrison), from the Rothamstead experimental station, is of great interest in this connexion. The authors find (Proc. of Royal Society, 1896) that silica does take part in the nutrition of cereals, especially of such as barley, whose ash is especially rich in silica, and that a free supply of soluble silica induces an increased and earlier formation of grain. The soluble silica seems to act by increasing the assimilation of phosphoric acid by the plant, not by an indirect action on the soil, but by a direct one upon the plant. Whatever the nature of the action may be, its importance in the cultivation of cereals is sufficiently obvious, for the presence of soluble silica in the soil will enable a smaller dressing of phosphoric acid to produce the same result as a larger one, or will enable the same dressing to bring about earlier and more perfect ripening and fruiting. All ordinary soils consist very largely of silica or of compounds of silica with insoluble bases. This silica can only be absorbed when brought into solution, as takes place to a very limited extent by the aid of the carbon dioxide dissolved in the water of the soil, and in other ways. The presence of alkaline carbonates in the soil increases the amount of soluble silica available for absorption by the plant, and hence must benefit it so long as the amount of alkali is not so great as to injuriously affect the roots of the plant. One objection put forward to the use of artesian water for irrigation is that the sodium carbonate which such waters may contain, to the extent of 30 or 40 grains per gallon, by accumulating in the soil, may render them injuriously alkaline. Analyses by Mr. Guthrie (*Agricultural Gazette of New South Wales*, July, 1906, p. 686) seem to show no such rise of alkalinity as might be expected after the irrigation by alkaline artesian water. It is possible that the sodium carbonate, acting on such substances as aluminium silicate in the soil, may form sodium silicate, which is capable of absorption by the plant, and is at once seized by it, leaving aluminium hydrate in the soil. This would, however, necessitate an increase in the percentage of sodium in the plant, of which we have no evidence. In any case, however, it is worthy of experimental trial as to whether the use of feebly alkaline artesian water for irrigation, instead of being injurious to cereals grown for grain may not favour their growth and production of grain, by rendering more of the silica of the soil available for their use. This soluble silica, as Hall and Morrison have shown, acts in the same way as an addition of phosphoric acid in favouring the formation and early ripening of the grain.

LIME AND ITS FUNCTIONS IN AGRICULTURE.

F. E. Lee, Agricultural Superintendent.

There are few substances which are used by the farmer that are less understood than lime. The name does not convey the information—that on this substance depends, to a large extent, the health and vigour of both stock and vegetable life. Perhaps it is, that lime in some of its forms is such a familiar object, that constant association has produced that contempt that is said to be bred by familiarity. No matter what the cause may be, the fact remains that the value of lime, as a soil amendment, solvent of plant food, and corrector of acidity, is not properly appreciated by the great majority of farmers in the State. Lime is sometimes spoken of as a manure, but this is an error; while lime forms one of the most important constituents of the soil, and is an essential ingredient in the ash of all plants, it is not a manure, but rather comes under the heading of a soil amendment.

Different Forms of Lime.

Confusion may often arise in the mind of a farmer as to what lime really is, and this confusion may be made worse when the difference in action of the various forms of lime is not completely understood. Lime is found in natural deposits in many parts of Victoria, in the form of limestone, or carbonate of lime. In this State, the lime is practically insoluble by rain water, and is of little or no value either as a soil amendment or plant food. If the limestone occurs, as it often does, as an outcrop, the surface gradually crumbles down by the action of the weather.

Limestone, when subjected to the influence of heat, loses the water and carbonic acid gas with which it is combined, and the product is then known as oxide of lime, burnt lime, caustic lime, or unslaked lime. As it comes from the kiln, the lime is still in the stone form. If allowed to remain exposed to the air, or if water is added, burnt lime crumbles into a fine powder, and is then known as slaked or hydrated lime; it is in this form that lime is most familiar, and in this form it is generally made use of by the farmer. After slaking, lime reverts, or turns back, to the carbonate form, but as it is then in a state of fine division, it is of much more service to plant life. Lime is also found associated with other substances, such, for example, as in gypsum or sulphate of lime, deposits of which are to be found in many localities in the northern districts of Victoria. Lime is also to be found in the ashes of all plants in greater or less abundance according to the class to which the plant belongs. The ash of the wood of fruit trees and vines is particularly rich in lime, as are also the ashes of most of our Australian hardwoods.

Functions of Lime.

The functions of lime are many and varied. On heavy clay soils, lime has the power of "flocculating," or binding the clay particles together in larger groups, thus permitting the soil to be easier worked, and allowing the better passage of moisture, air, and warmth. On light sandy soils, the particles of which are already too loose and separate, lime has the faculty of binding the particles together, which helps to arrest the rapid drainage of such soils, and at the same time prevents their becoming too hot. The action of lime then is exactly opposite on two types of soil.

It is, however, as a corrector of soil acidity that lime is most favorably known. Any soil which is badly drained, or which contains an excess of vegetable matter, gradually becomes acid, due to the action of soil bacteria in the latter case. When the degree of acidity passes a certain point, the vegetation changes character, and we find the good grasses supplanted by a growth of coarse vegetation.

Swamps are conspicuous always for the growth of rushes, reeds, and coarse tussock grasses they produce. The action of lime on drained land is to neutralize the natural acidity, and "sweeten" the land. An easy method for the farmer to ascertain if his land contains too great a degree of acidity, is to place a piece of ordinary blue litmus paper on a sample of moist soil; if the paper rapidly turns a vivid pink, it may safely be assumed that the land requires a dressing of lime. If the change of colour is effected slowly, it is an indication that, while lime is needed, a light dressing will suffice. Blue litmus paper may be procured from any chemist, in small books, costing 3d. or 4d. for 50 sheets.

As a solvent of latent plant foods, lime is of the greatest assistance to the farmer. It must be remembered that time exercises a chemical action in the soil, and it will be found, especially in clay soils, that a dressing of lime or gypsum plays an important part in releasing potash from its insoluble forms. There used to be an old saying among English farmers that lime "made a rich father and a poor son," and this old adage, while not strictly true, has nevertheless a foundation of truth. The manner in which lime is nowadays used differs entirely from the methods in vogue 50 years ago; then it was the custom to apply a dressing of from 5 to 10 tons per acre, the effects of which would remain for eight or ten years. It is the custom now to use 5 to 10 cwt. per acre, and make the application every three or four years, the effect being more noticeable and more lasting. One more example of the benefit of lime in the soil is sufficient to completely convince the progressive farmer of the necessity of giving more attention to this valuable aid to agriculture. Almost without exception the artificial manures that are used require to find in the soil a base with which to combine, or otherwise they would leach out of the soil after periods of heavy rain.

The universally used superphosphate, above all other manures, should be held near the surface of the soil, or, in other words, within the sphere in which the roots of all crops draw their nourishment from. As has been pointed out in a previous article on artificial manures in the *Journal*, the phosphoric acid in superphosphates is rendered "water soluble" for distributive purposes mainly, and it is well-known that within a comparatively short period after application—this water soluble phosphoric acid reverts or changes back to the more lasting, but slightly less soluble form of "citrate soluble"; this reversion is brought about by combination with lime found in the soil. The nitrogen in sulphate of ammonia, bonedust. blood manure, and farm-yard manures, is released by the action of soil organisms, and after combination with lime, is slowly taken advantage of by the roots of crops. It would be a difficult matter to find a soil absolutely deficient in lime, but there are many thousands of acres in Victoria, the lime content of which is below what it should be. Land which has been continuously grazed by dairy cows is liable to become exhausted in lime, owing to the large amounts removed in milk. The constantly recurring outbreaks of cripples and kindred diseases are, in themselves, sufficient to indicate that many localities are already suffering

from an impoverishment of lime or phosphatic materials in the soil, and unless some improvement is made in the direction of treating pastures, these troubles are likely to increase.

How and when to Apply Lime.

Before the maximum benefit can be derived from the use of lime, the object with which it is given must be clearly understood. If it is desired to break down stiff clay soil, caustic or burnt lime should be used, so that the double object of correcting acidity and improving the physical condition of the soil may be achieved. If it is desirable to arrest the rapid drainage of sandy soils, slaked or mild lime is best. For peaty soils, caustic lime is preferable, because it promotes decomposition more rapidly; for newly-drained land, caustic lime is best on account of the usually high degree of acidity in such soils, and also in order to assist in the free passage of air and warmth. Under no circumstances should lime ever be applied within at least five or six weeks of the sowing of seed or artificial manures. The proper time to apply lime is in the early autumn, and it should be distributed broadcast, or by mechanical spreaders. Lime should never be ploughed in, but is best applied immediately after ploughing, and then harrowed in. The logic of this will be readily grasped when the reader considers that it is the upper portion of the soil in which plant roots mostly feed, and every effort should be made to improve that portion of the soil. If the lime were to be ploughed in, the effects of it would only commence 6 inches below the surface, and the objects desired would be defeated.

Gypsum.

Under the name of gypsum or sulphate of lime, there are to be found in various parts of Victoria deposits of lime compounds. As is well known, superphosphates contain large amounts of gypsum produced during the process of manufacture, and an impression widely prevailed that superphosphates were nothing more or less than gypsum, to which phosphoric acid had been added. The more general use of manures, and the information disseminated by the Department of Agriculture has completely dispelled this illusion.

Gypsum has deservedly of late years come into vogue in many of the southern districts of Victoria as a top dressing for grass land. The particular function of gypsum seems to be the unlocking of the potash compounds held in an insoluble condition by clay soils. It has furthermore been remarked that this substance promotes a growth of clover in pastures where the grass has not hitherto been a prominent feature. The experimental pasture fields distributed from the eastern to western extremes of Southern Victoria have done much to popularize the use of gypsum, and although the growth of grass has not been conspicuously promoted, the droppings of the stock feeding on the lime and gypsum plots is sufficient evidence to show that the feeding qualities of the pasture have been improved by their use. As an absorbent of ammonia, gypsum takes a leading place, and its use in the stables is to be strongly advocated in the prevention of the loss of the most valuable portion of animal excrement, viz., the nitrogen. Sprinkled about the stable and stall, gypsum not only absorbs the escaping ammonia, but greatly minimizes the objectionable smell of these places. Where stable refuse is conserved outside, a few handsful of gypsum could, with advantage, be used with every barrow-load of refuse.

Conclusion.

As the purpose of this article is simply to direct attention to the use of lime, it is to be hoped that sufficient has been said to impress the reader with the fact that where lime can be cheaply procured, its use is to be recommended for most crops. Gypsum and marl serve much the same purpose as lime, but it must be borne in mind that they have no caustic effects, and that larger amounts are necessary to effect the same purpose. By the fruit-grower lime should be used to a much greater extent than it is, on account of the vigorous stocky growth it promotes, and for the assistance it renders in hastening maturity.

While every soil does not need lime, there are few portions of Southern Victoria where moderate dressings could not be used with advantage.

CLOSER SETTLEMENT STUDIES.

J. M. B. Connor, Dairy Supervisor.

A.—AN UP-TO-DATE DAIRY FARM.

The milk supply of our large cities is to-day one of the most important problems of public health. Milk constitutes such an important factor of

GENERAL VIEW OF FARM BUILDINGS.

Some of the dairy cows in lucerne paddock.

the food supply, and because of its cheapness and high food values, has such a general use that too much importance cannot possibly be placed on the methods of its production.

To watch the methods adopted of milking cows on many dairy farms is to watch a process of unscientific inoculation of a pure medium with unknown quantities of germ life. From cow to cow the milker goes, taking with him or her, as the case may be, from the last cow milked the particles of dirt caught from the floor, the hairs, the dust, and the germs that adhere to them.

Throughout the whole process of milking, the milk, whilst standing in the bucket, receives its repeated sowings of germinal dirt. In an hour

or two its population of triumphant lives is a thing to make one's blood run cold. And this occurs in what are considered good dairies. Imagine what it must be like where cows' flanks are never groomed, where hands are only washed by accident, where expectorations (tobacco or other) are not infrequent, where, in a word, the various dirts of the dirty milker are at every hand reinforced by the inevitable dirts of the domesticated cow. I could name many dairy farms where these conditions are, in a greater or less degree, normal. All men milking cows, to insure a clean and pure supply, should be required to conform to certain rules and regulations before a permit is issued for the sale of milk for human consumption.

After driving about 6 miles south of the city of Bendigo, along a bush track, through thinly-timbered but poor, uninteresting, and hungry-looking country in its unimproved state, from an agricultural point of view, it

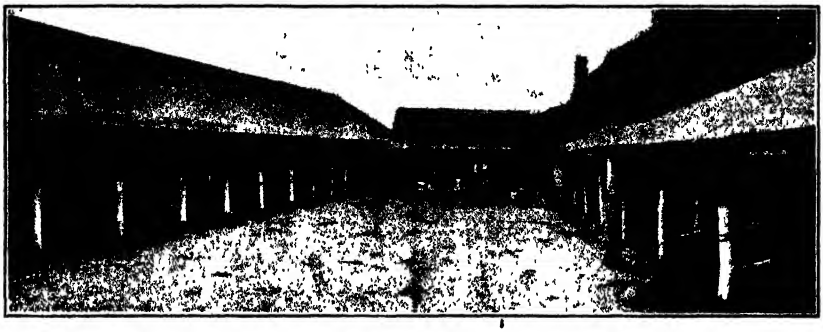
THE HOMESTEAD.

is a great treat to meet with a practical, go-ahead, and up-to-date dairy farmer in the person of Mr. George Lowe, of "Kedleston Dairy," Mandurang, the owner of the farm under review. The farm, which consists of 260 acres of land, is securely fenced and subdivided into convenient paddocks, ranging from 10 to 80 acres, each paddock being provided with a substantial gate painted white. The Sheepwash Creek runs through the property, and it is on the flat near the creek that Mr. Lowe cultivates about 40 acres for hay. Portions of the flat have been under constant cultivation for forty-five years, returning, on an average $2\frac{1}{2}$ to 3 tons of hay to the acre. These good returns are largely accounted for by the practical and sensible method of conserving the whole of the farm-yard and liquid manure, and turning it to account. The balance of the farm, with the exception of 2 acres of orchard adjoining the homestead, and 3 acres of lucerne, is devoted to grazing the dairy herd. Last year the 3-acre paddock was sown with a crop of oats, drilled in at the rate of one bushel to the acre; the lucerne was sown broadcast at the rate of 10 lbs. to the acre. The oats were cut for silage, and the lucerne was at once irrigated, and grew splendidly, giving three cuttings during the

first year. The owner, with the aid of irrigation, intends going in strongly for rye grass, clover, and lucerne growing.

The dairy herd consists of thirty-seven head of good dairy sorts, the Ayrshire strain predominating. They return on an average 2½ to 3 gallons per day, and the milk is retailed in Bendigo with two delivery carts daily, being sold by the quart. Mr. Lowe has built up the herd by constantly culling the duffers, and never losing sight of the fact that it is necessary to have a pure sire, descended from a milking strain, to breed from. The first bull introduced into the herd some years ago was an Oakbank Melbourne Show bull; last year a young milking shorthorn bull was purchased, and will be used from this out. I have no doubt that the cross will be a beneficial one.

The cows are stall-fed over night, thoroughly groomed every day, and bedded down with plenty of straw. Mr. Lowe finds this system gives handsome returns, inasmuch that it provides one of the most valuable products of the farm, abundance of farm-yard manure, for cultivation purposes, besides the benefit of not having to go out into the paddocks on a cold, frosty, or wet morning to yard the cows.



THE MILKING-SHED.

The milkers' hands and the cows' teats are washed before milking, and the milk, immediately after it is drawn, is taken from the byre to the cooling room. It is then strained and run over the cooler; the water, which cools the milk down to 62 deg. F. during the hottest weather, is pumped from an underground tank by a force pump, the water returning to the tank after running through the cooler. There are two large underground tanks, which insures an unlimited supply of water, besides admitting of the occasional cleansing of one of the tanks.

The cow byre is built with lofty walls, is well lighted and ventilated, and opens on to a splendidly paved and beautifully drained court-yard. The roof is double lined, first with palings, and then with corrugated iron. All roofs on the farm buildings are provided with spouting. There are twenty-eight bails, 5 feet wide, paved with nice flat blue sandstone, with a gutter 1 ft. 6 in. at the rear of the cows. A drain, which is 1 ft. 2 in. wide x 4 in. deep, conveys all drainage from the cows and farm-yard buildings generally into a 6-feet brick underground tank, puddled with clay, and afterwards cemented. On this tank there is erected a fairly high pump, and when full, which takes about six weeks, the contents are pumped into a tank on wheels, made for the purpose, and

distributed on the land, or on a large heap of soil, which is turned and well mixed at various intervals, and makes splendid manure. This simple and effective method of conserving this valuable product at a minimum cost is worthy of the attention of every dairy farmer in the State. It is only necessary to see the results Mr. Lowe obtains from his land to know the value of saving all farm-yard and liquid manure. The contrast between this farm and the poor, hungry surrounding country is indeed great. The stable, with loft, is built of brick and stone, pitched with bluestone floor, and contains five stalls. The loft is used for storing oats, bran, and other fodder for the dairy herd and working horses.

Irrigation.—Mr. Lowe knows the value of having an unlimited supply of fresh water conserved for growing green fodder for his dairy herd during the hot, dry months of summer. He has constructed a large dam, with a holding capacity of about a million and a half gallons of water,

MILK READY FOR DELIVERY.

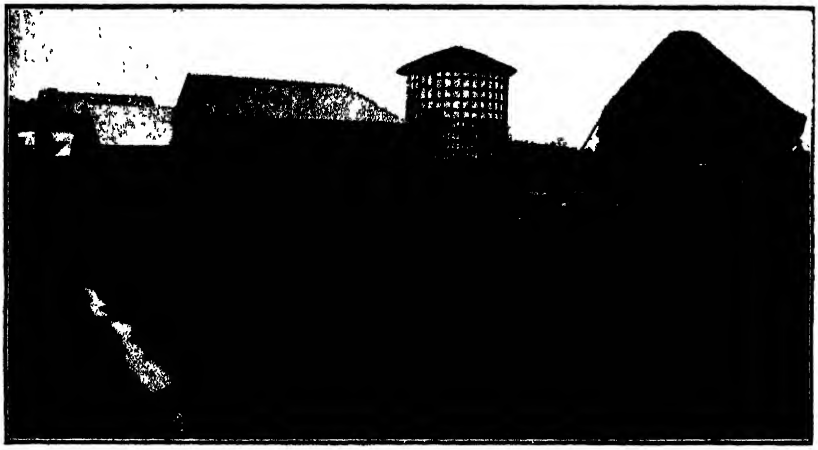
built 20 feet above the level of the homestead. A 2-inch main pipe from the dam is laid on to different parts of the buildings, and is found a great convenience for flushing down the bails and drains. For irrigation purposes, the water is drawn over the bank by a 4-inch syphon, which gives an ample supply for irrigating the lucerne and maize crops during the summer months. If the dam becomes low, it is refilled from the Coliban channel at a cost of £4 per million gallons. This is considered a rather heavy charge, and Mr. Lowe maintains that if the water could be obtained at a cheaper rate it would be used more freely by himself and other farmers for irrigation purposes.

Feeding Methods.

The Silo.—The method of conserving and converting into silage the green succulent feed, which is so plentiful everywhere, as a rule throughout the spring, must in the near future be adopted by every dairyman. Mr. Lowe is so pleased with his short experience that he intends erecting

another overhead silo. The one now in use on the farm has a 70-ton capacity, being 18 feet high, 16 ft. 10 in. in diameter, with 4 x 2 uprights, and 3 x ½ battens, and lined with 22-gauge galvanized iron, riveted. Mr. Lowe found that after the first filling the iron started to bulge out between the uprights, so he put an extra 3 x 2 upright between each of the others to the height of 12 feet, and to further strengthen it he placed two 2-inch iron bands, 2½ in. x ⅛ in., around the silo at a distance of 3 and 9 feet respectively from the ground. The band is in two sections, joined by a bolt, with a screw on each end, so that it can be screwed up in two places. The roof is constructed of thatch, tied down to ordinary saplings secured from the bush close by, and it throws the water off splendidly.

Growing the Crop for the Silo.—The six acres of cultivation land is manured with sixteen loads of farm-yard manure to the acre, and is well ploughed and worked to a fine tilth. It was sown in May with



SILO, CHAFF-HOUSE, AND ENGINE-ROOM.

oats at the rate of 1½ bushels to the acre, and the crop was taken off about the end of November; the 6 acres were immediately reploughed and sown broadcast with maize, and irrigated from the dam three times during the season. Last year, Mr. Lowe informs me that it grew to a height of 10 feet in some places; but, taking the crop as a whole, it averaged 7 feet, being so heavy that the maize binder would not cut it.

Filling the Silo.—The chaff-house is quite close to the silo, and has a door in the roof for the elevator, which is worked with a chain belt running on two sprockets, with cups about 1 foot apart. The green fodder is carted up to a big door in the top of the wall, and thrown in almost on the chaffcutter, doing away with the double handling. The chaffcutter, which keeps the carters going, is driven by a 3½ horse-power oil engine, and cuts about ¾ inch long, working the elevator at the same time. The silo is filled twice a year, once with the oats, and then with maize.

Feeding.—The fodder, which is taken from the silo by means of a chute, is used at the rate of eight bags a day. It is mixed with three bushels

of bran, and feeds 28 cows daily during the summer months. During the winter the fodder is used at the rate of six bags of maize silage, four bags oaten chaff, and six bushels of bran. The silage was found to be so succulent that it contained enough moisture to sufficiently damp this ration of feed without any addition of water. Mr. Lowe speaks very highly of the great benefits to be derived from always having abundance of silage for both summer and winter feeding, and the condition of his herd speaks volumes for the soundness of his methods.

The whole of the farm work is carried out by Mr. Lowe and his two sons, except during harvesting, when a casual hand is employed. Within a radius of 15 miles of Bendigo, there are thousands of acres of waste lands similar to this farm, which are eminently adapted for dairying and intense culture. In its unimproved state it does not look very inviting, but I am convinced, after inspecting this farm of Mr. Lowe's, that, with the aid of water and manure, and not a great deal of labour, that this vast wilderness could be converted and transformed into smiling and lucrative dairy farms. This would give employment to thousands of men, who, if these now waste lands were thrown open, would be comfortably settled and enabled to earn a livelihood, besides helping to maintain and build up the city of Bendigo.

B.—A SUBURBAN HOMESTEAD.

One of the most striking instances of what one man can accomplish successfully by systematic rotation of crops came under my notice lately when inspecting Mr. Leonard Fairhall's dairy herd at Burwood. The farm in question consists of 10 acres of land, composed of grey sandy loam, with a red clay subsoil. It is sub-divided into three paddocks, varying from 2 to 5 acres. The whole is drained by underground pipes, Mr. Fairhall attributing a good deal of his success to thorough drainage. Five acres are devoted exclusively to intense cultivation. The balance is sown down with grasses, and grazed by the dairy herd. The farm has been carrying 13 cows in full milk, three dry cows, and one horse, the dry cows coming in at varying times of the year, and keeping up the milk supply. The cows are in splendid condition, rather larger-framed than the general run of herds, and of robust constitution. They are milking at the present time 112 quarts daily: 80 quarts are sold wholesale at 7d. per gallon on the farm, the balance being separated, and returning 21 lbs. of butter weekly, which is sold on an average of 1s. per lb. all the year round. The milk payments are £8 3s. fortnightly, and with the sales of butter bring the monthly returns from the 13 cows to £20 10s.

The only feed purchased outside the crops grown on the farm is star branning, which is used at the rate of one bag per week, at a cost of 3s. 6d. per bag. It is mixed with the green chaffed fodder. Mr. Fairhall does not believe in carrying all his eggs in one basket, and always has a crop of vegetables for sale coming on. At the present time there are ½-acre of carrots (James intermediate and Belgians), ½ an acre of millet and amber cane, 1 acre of maize, and 1½ acres of oats. As soon as the crops

are harvested, the land is manured at the rate of 12 loads of farm-yard manure (all produced on the farm), and ½ cwt. of superphosphates to the acre, the ground being thoroughly tilled and brought to a fine tilth before sowing. The maize crop sown in March was 5 feet high, and ready for cutting in June; it grew to a height of 6 feet, and fed the whole of the animals during that period, and was fed at the rate of four loads each day. The land was immediately re-sown with barley. There are also 2½ acres of oats and ½ an acre of cabbages (early Easthams), at the rate of 5,000 plants to the acre. The cabbages were an enormous size at the time of my inspection, and the owner informed me that three plants were a sufficient meal for one cow, as they weigh from 8 to 12 lbs. each. The owner expects crops sown at present to yield ample feed for his cows right up to the winter. During the summer months, starting from January, he irrigates the cultivation crops by gravitation with the

EARLY EASTHAM CABBAGE 11½ LBS., 5,000 PLANTS TO THE ACRE.

Yan Yean, using 10,000 gallons, at a cost of 10s. per week, giving the land a thorough weekly soaking until March. Besides keeping the herd, the owner, for two months, sold parsnips, returning 15s. per week. All the calves are kept for a few weeks, and then sold at 8s. per head. Eight pigs, which cost 5s. each as suckers were fattened and sold at 27s. each. In season the owner always has a crop of onions, carrots, parsnips, cabbages, French beans, potatoes, gooseberries, and rhubarb, and the present crop of the latter is very advanced, owing to repeated applications of liquid manure, caught in a pit from the milking shed. The cows are fed in the open, and appear to be thoroughly contented. The homestead and farm buildings are neat, and one receives, upon entering the premises, an impression of contentment and prosperity. The receipts are at least £250 per annum, which, from so small an area, must be regarded as very satisfactory. The rent paid is £40 per annum.

FARM-FED PORK AND VEAL.

A. A. Brown, M.B., B.S., Inspector of Foods for Export.

A few weeks ago I paid a special visit of inspection to the auction-rooms of Melbourne where dead meat, killed by farmers on farms in all parts of the country is consigned and sold. As regards pigs, many carcasses were very poor, and brought only from 2d. to 1½d. per lb. On the other hand, prime porkers brought from 5d. to 5¾d. per lb. The poor carcasses that brought only from 2d. to 1½d. per lb. were evidently derived from pigs that had been grass fed or fed upon skim milk, and it should be firmly impressed on farmers that there is no profit in forwarding inferior pork to the markets of Melbourne. To fetch payable prices pigs should be well fed, and, if allowed to roam at large, they should be run on lucerne paddocks. Lucerne is the king of fodders for pigs to graze upon, and it has a nutritive ratio of as 1 : 2 .3, that is, there is 1 lb. of digestible proteid or nitrogenous compounds to every 2.3 lbs. of carbohydrates (sugars and starches). Rape is also a good crop over which pigs should be allowed to graze, but it has not the same value as lucerne, since its nutritive ratio is as 1 : 5.7, and is somewhat too wide. To fatten pigs in a proper fashion, and secure firmness of flesh and fat, a ratio of 1 lb. of digestible proteid to every 4 lb. of digestible carbo-hydrates is what should be aimed at. If carbo-hydrates prevail largely in the ration, the flesh and fat are soft, and pigs so fed do not make prime bacon. The chief concern in feeding pigs is to keep the animals upon a narrow ration, that is narrow as regards the quantity of proteid to the other constituents. It will be found in actual practice that if a highly nitrogenous ration is given, the other constituents (sugar, starches, and fats) will be found present in large enough quantities to meet all the requirements of the animal.

Peameal, or oatmeal, or beanmeal should prevail in the rations of every young pig, and the food should be given in skim-milk, or butter-milk, warmed to 100 degrees Fah. With older animals a diet in which any one or more of the following foods, which are all rich in nitrogen, and in which the nutritive ratio is as narrow as is required should prevail. Peas, whole or crushed, beans, whole or crushed, pollard, oats, brewer's grains, cocoanut-meal, sunflower seed; and rape-seed meal, given in skim-milk or butter-milk, should be regularly fed. Cotton-seed meal, or linseed meal might be occasionally given with advantage. They are laxative in action as well as being rich in proteids.

Pigs also require plenty of wood ashes and ground green bone, or bone-meal in their rations. The rations should be plentifully supplied, quite up to the limits of capacity, since it is required to produce small carcasses as quickly as possible, and then when the pigs attain a certain weight, they should be instantly disposed of. Quickness in getting the porkers ready for market should be the aim; and conducting operations on these principles will give large profits. Somewhere about 400 lbs. of any of the foods above mentioned will put 100 lbs. live weight on a pig.

Some little time before slaughter pigs should be penned up and topped off. A highly nitrogenous diet is absolutely essential in imparting firmness to the fat and flesh. It is quite easy to determine carcasses that have been fed largely on carbo-hydrates. From the outset of existence pigs should be well fed. If they should happen to get a set back just as they are starting

life, it takes a long time to overtake and repair the damage. Whole milk is the best food for very young pigs. In the absence of whole milk, skim milk and linseed meal or oatmeal make a good diet.

At one of the auction rooms pork from Tasmania was sold, and realized top prices. This pork was derived from pigs that had been well fed, and there were not many carcasses about that could compare with them.

To realize top prices carcasses should weigh between 60 to 80 lbs., and should be well bled and then well dressed. Prime porkers always fetch more than bacon pigs. Bacon pigs, well fed and fairly well dressed, brought from 4d. to 4½d. per lb. They should weigh 120 to 160 lbs. It is not advisable to send carcasses of pork or veal to Melbourne in the beginning of the week. These commodities should be sent away Thursday, or Thursday night, for Friday's market, as the sales start at 10 o'clock on Fridays. The chief demand for veal and pork is at the end of the week, and no farmer should fail to note these observations. These observations are based on actual experience of the conditions prevailing in the meat markets of Melbourne.

Dressing Pigs.

Very few farmers would seem to possess a sound knowledge of the technique associated with the killing, scalding, and dressing of pigs for market. Some scald their pigs in water far too hot, thus reddening the skin and so depreciating the value of the carcass. Many such carcasses brought only 4¾d. per lb., whereas if they had been properly treated they would have brought 5d. or 5¼d. per lb. Again others do not scald with water hot enough, since the dehairing is noticed to be defective. The temperature for scalding is about 160 degrees Fahr., and this temperature is roughly attained by mixing three buckets of boiling water with one of cold.

The carcass of the pig after it has been stuck and bled is immediately thrown into the scald, and kept in motion in the hot water. It is kept in motion by seizing hold of the nose, and then twirling it round and round. This movement is kept up for fully five minutes before commencing to scrape the carcass. After being scalded the carcass should be shaved (that is thoroughly scraped) in the hot water. When that operation is complete the carcass should be thrown into a tub of cold water, and there the head and feet should be completely shaved; it is then removed from the cold water tub and hung up, and again scraped. After being again thoroughly scraped the belly is opened from the aitches to near the tip of the lower jaw. Then all the entrails are removed, and the inside and also the outside of the carcass washed well with clean warm water. No blood stains should be allowed to remain on the carcass. As a last washing cold water should be thrown over the carcass. Now it should be scraped with a piece of clean bent hoop-iron, so as to remove all water adhering to the carcass, and finally it should be well rubbed with a dry cloth and rubbed dry, and a belly-set put in position. It should, when all the operations are completed, be hung in a place which is well ventilated, but free from draughts. If hung in a draughty place, and more particularly if the carcass be very moist, it will turn a reddish-yellow colour, sometimes even presenting the appearance often observed in pigs just recovering from an attack of swine plague. When set, and just before despatch to the railway, each carcass should be encased in bagging material. New material should always be used for this purpose.

Calves.

With regard to calves it is not much use sending poor ill-fed carcasses to the meat market, as they are unprofitable to the sender. Calves should be fed for some ten days after birth upon whole milk, and then gradually fed upon skim-milk, to which linseed meal or oatmeal is added to make up for the fat deficiency. They should not be killed less than six weeks old if one wishes to realize good prices. At this age they should weigh from 50 to 80 lbs. in their jackets, depending upon the breed. On examining calves in the auction room one cannot fail to be struck with the general poverty prevailing in their condition. Carcasses of calves well fed, last Friday (31st August), brought 3d. per lb., ill-fed carcasses, however, only realized 1½d. per lb. The carcasses are usually badly bled, roughly washed, and packed in bagging before the animal heat has dissipated.

On being slaughtered the carcasses should, after being disembowelled, be completely washed of all blood stains, and on no account should the incision be sown up. The carcasses should be belly-setted and allowed to cool, and then after being set should be bagged in new clean material. The head and feet should be cut off and used on the farm; these portions of the carcass are removed in Melbourne and sold separately, and only fetch 2d. to 3d. per set (feet and head). No calves should be brought in from wet paddocks and immediately slaughtered, but should be allowed to get dry and then dealt with. When slaughtered with their skins wet they do not present an inviting appearance.

PRESERVATION OF MEAT.

A. A. Brown, M.B., B.S., Inspector of Foods for Export.

Salting.

The preservation of meat by the agency of salt (Sodium chloride) is one of the oldest and most widely-used processes. Salt acts partially as a dehydrating agent—that is, it deprives the meat of water—and partially as an antiseptic. In salting meat to preserve it from decay, various methods are employed. Some preservers adopt one method, some another. In order that any process may be successful, attention must first of all be directed to the slaughtering of the animal whose carcass it is intended to preserve. A cool day should be chosen for the slaughtering; the animal should be well bled, and, after having been carefully dressed, the carcass should be allowed to hang in a cool place until the animal heat has dissipated. This condition is indicated by the carcass setting firmly. After the carcass has set it should be cut up.

There are various ways of salting meat, and any of the following will give successful results:—

1. For each 100 lbs. of meat, employ a thoroughly incorporated mixture of 8 lbs. of Black Horse salt, 3 lbs. of granulated sugar, and 4 oz. of saltpetre. Rub the meat to be treated on all surfaces with one-third of the mixture, and then pack it in a barrel. Let it remain there for three days; then take it out, and rub it again with another one-third of the salt mixture. In putting the pieces back into the barrel, place those that were previously on top at the bottom of the vessel. At the end of another three days take the meat out again, and rub it with the last one-third of the mixture. Three days after this the meat will be cured. Now

take it out of the barrel, place it on a board over the barrel, and allow it to drip into the barrel for a day or two. It can be used when partially cured, as occasion demands, at any point previous to this stage, if the preserver so wishes. If it is now required to keep the meat still longer, it should be rubbed over with a little dry salt, and when dry it should be smoked. The process of smoking greatly assists in the preservation of meat, partly on account of the drying action of the heat associated with the smoking, and partly through the antiseptic action of some of the substances in the smoke. The best substance to use to make a dense smoke is the finest New Zealand pine sawdust (Kauri pine). The preservation of the meat in hot weather is also greatly assisted by adding to the brine formed during the process a little sodium sulphite. Add for every 100 lbs. of meat half an ounce of sodium sulphite to the brine. The liquid that is found in the barrel during the process should not be removed, but the meat should be repacked in it each time it is taken out from it.

2. A second method consists in placing the meat in casks in layers, with salt between each layer. The salt withdraws water from the meat, and the brine that is formed penetrates the substance of the flesh.

3. A third method consists in pumping a strong solution of salt, by means of a brine pump, into the arteries. This method I have demonstrated to butchers, and is a rapid and effective way of preserving meat.

Any farmer, however, can employ methods No. 1 and No. 2; and, if he treats fresh flesh on a cool day as directed, he will get successful results. The use of water in making a pickle should be avoided, since the water supply on a farm is usually contaminated with micro-organisms that rapidly cause putrefactive changes in flesh. If, however, curing by brine is desired, about 3½ lbs. of salt should be added to every gallon of water, and the water should have previously been boiled. The brine made on adding the salt to the boiled water should be filtered through a double fold of cheese-cloth, to remove various impurities. The pickling barrel should be kept in a cool, well-ventilated place.

Bacon Curing.

Kill the pig on a cool day by sticking it in the throat, just above the breast-bone, in the mid-line; then incline the blade downwards and backwards, still sticking to the mid-line, and the large blood vessels will, if the operation be carried out as directed, be severed, and the pig will then properly bleed. Then, when bled, plunge the carcass into a capacious vessel containing hot water made by mixing one bucket of cold with three of boiling water, which will give a temperature of about 160 deg. Fahr. The carcass must be plunged into an abundance of hot water, and, when it is in the tub, move it about for fully five minutes by seizing hold of the nose. Scrape it well in the hot water, and, when scraped, plunge it into a tub of cold water and scrape it again, removing all hair from the carcass, and cleaning the head and feet thoroughly. Any hair that does not readily come away should be shaved off with a sharp knife. Then hang the carcass up, open it, remove entrails, and wash it well with warm water, and afterwards with cold water. Dry it well with good clean rough cloths, and allow it to hang in a cool place, free from draughts, until the animal heat has left it. If hung in a draughty place, the carcass will turn a yellowish-brown colour; so avoid hanging in draughts. After the carcass has set it should be cleanly divided by cleaving or sawing down the spinal column; then the back-bone, and also the shoulder-blades should

be removed. The sides should be well trimmed, and each side should be thoroughly rubbed over with 5 lbs. of salt to every 100 lbs. weight of meat. The sides should, when all this has been completed, be laid in the pickling tub, and allowed to remain there for, say, two days. They should then be removed from the tub and placed on a table. The brine should be thrown away, and the pickling tub thoroughly cleaned. A mixture of 5 lbs. of salt, 2 lbs. of sugar, and 2 ozs. of saltpetre should be thoroughly incorporated by rolling with a rolling pin. Each side should be rubbed with the salt mixture, and placed back in the pickling tub; but, before being replaced, the blood veins should be removed. On each alternate day take out the sides, and rub them well with more of the salt mixture, and replace the sides in the tub, taking care that those that were previously uppermost are now placed at the bottom of the tub. Continue this rubbing and changing of the sides for twenty-one days, and at the end of that period they will be cured. When finally removed from the tub, the sides should be plunged into hot water for a few minutes, scrubbed, and then immersed in cold clean water (as cold as can be procured) for four hours, and afterwards thoroughly dried by rubbing with clean cloths. Wipe out the pockets made by the removal of the shoulder-blades with a weak solution of formalin, so as to prevent slime and moulds forming there, and then rub in a little sodium sulphite. Rub the sides over with oatmeal or maizemeal containing a little sulphite of soda, hang them up to dry, and when dry smoke them. When smoked, encase them in a covering of cheese-cloth, to keep away flies. In very hot districts the whole side could with advantage, after being taken out of the cold water, be plunged into a solution of sodium sulphite, to further assist its preservation. A solution of 3 ozs. to 10 gallons of water will be strong enough for the purpose. If necessary, the sides can be cut up into hams, shoulders, and middles, and the pieces treated as directed for the sides. The middles would be cured in about sixteen days. The amount of salt that is taken up during the curing process varies, but it ranges from about 6 to 8 lbs. per 100 lbs. of meat.

Bacon sold in the markets is not now allowed to contain more than .125 per cent. of saltpetre, and so definite quantities should now be used in the curing process. Decolourization occurs as one of the results of salting meat, and it is the custom amongst preservers to add a small proportion of saltpetre to counteract this. Saltpetre not only restores the colour, but acts as a preservative.

In curing bacon, where a brine pump is procurable, it is a thoroughly scientific method to inject into the arterial system a saturated solution of brine. The brine forces out all blood in the blood-vessels, and penetrates everywhere. It goes even into the tissues of the bones themselves. This method would put an end to bone-taint, and bacon curers should generally adopt this way of getting rid of blood from the carcasses.

The feeding of pigs intended for bacon purposes is a matter demanding great attention. All animals should be well and properly fed. The great majority of pigs slaughtered for bacon purposes is unsuitable for the trade, since they have not been satisfactorily fed. To make prime bacon, highly nitrogenous foods, such as lucerne, rape, oats, peas, beans, clovers, pollard and milk, peameal, beanmeal, &c., should be regularly fed. If other products exist about the farm which it is desired should be converted into bacon, the fact that nitrogenous foods are absolutely essential to the making of good bacon should not be lost sight of. If any of the starchy foods, such as maize, have been fed to pigs during

their early life, then, for some six week before slaughter, the diet should be highly nitrogenous. The nitrogenous diet impresses firmness on the fat and flesh, and animals so fed can be readily diagnosed.

FEATHER EATING.

H. V. Hawkins, Poultry Expert.

An inquiry from an amateur poultry breeder as to the cause of feathers falling out under the neck of the cockerels belonging to him has been referred to me for reply. As there are doubtless other owners experiencing the same trouble with their poultry, I have deemed it advisable to reply at length, especially as the inquirer states that the same thing occurred last year.

There are many reasons why feathers come out, but the cause in this particular case would appear to be that the mischief is due to the lack of nitrogen available in the food supply. All laying hens crave for nitrogenous foods, particularly at this time of year, when they are at their highest pressure—*i.e.*, laying heavily. By careful observation, it will be noticed that the hens will pick at the juicy young feathers on the neck of the male birds. Gradually the thirst for blood increases, and probably several of the hens will attack his neck hackle until it is quite bare and reddish-looking; often the comb of the cockerel is attacked, and once blood is drawn, they keep on picking at the same spot, gradually creating a cavity at the base of comb. Strange to say, it has a hypnotizing influence on the male bird, who rarely objects to the treatment; in fact, he will hold his head down, and go off to sleep, while several of his mates dig away, and enjoy the protein which the comb supplies, much to the annoyance of the owner, who realizes too late that the one-time beautiful, upright head-piece on his Minorca or Leghorn has been seriously injured. Gradually it is seen to slightly fall, and the friction caused by the comb leaning to one side creates a deep wrinkle, a cankerous growth sets in, and the comb of the cock is completely ruined. When a case occurs, it is always desirable to dub the comb—*i.e.*, cut off with a sharp razor—otherwise he will practically starve in the pen, and the fertility of the eggs will be in great danger.

The remedial measures are—First, keep the cockerel away from the hens the greater part of day, allowing him to be with them only half-an hour morning and afternoon. Second, add to meal 1 oz. (per hen) of ***animal*** (protein) food daily—*i.e.*, sheep or bullock's liver or heart, or, what may often be obtained for nothing, wild rabbit; soak over night, and lightly boil, using the soup in mixing the pollard (two parts) and bran (one part) meal; or a sheep's head or a portion of liver may be hung up in a net suspended 2 feet from the ground. This will give the hens exercise, and provide their wants. The same practice may be followed with a cabbage, which at this time of year is especially needful in supplying the mineral salts so necessary to the laying hen. Don't give ***too much*** grain; it tends to dry up the system, and a scurvy skin, with liver troubles, eventuates. Remember, fowls are not granivorous, but insectivorous. Supply the substitute (animal food, &c.), and you will find your flocks satisfied, and the eggs strong in the embryo, resulting in chicks with greater stamina.

THE CURRANT.

James Lang, Harcourt.

The currant succeeds best in the cooler districts of the State near the Dividing Range. It also does well in some of the other districts, where a good rainfall is assured, provided the garden soil is good and well drained.

Propagation.

Currants are propagated by cuttings and layers, although this latter method is very seldom resorted to. Strong, clean shoots of one year taken from the plants should be cut into lengths of from 12 to 15 inches long, the base of the cutting being cut off square with a sharp knife just below a bud. The buds should then be cut out with a knife, leaving the four top buds to form the branches; if the buds are taken out clean, it will prevent the plants from throwing suckers. In planting the cuttings, they should be put in rows 2 feet apart and 6 inches between the cuttings; insert them in a slanting direction about 9 inches deep, leaving the buds above the surface. The cuttings should be trodden in firmly, especially at the base. Keep the ground well hoed and free from weeds during the growing season, and they will be fit for planting out the following winter.

Preparing the Ground.

In making a currant plantation, see that the plants are placed in a plot by themselves, as it is a mistake to put them amongst orchard trees. The ground should be deeply ploughed to an average depth of 8 inches during the spring, and allowed to lie fallow throughout the summer, with an occasional stirring up with the scarifier to keep weeds down. About the end of March or beginning of April, the land should be again ploughed and harrowed level; it will then be fit for planting.

Planting.

The plants should be planted in rows 6 feet apart and 6 feet in the rows; this gives plenty of room for working the ground with the horse. In preparing the young plants for planting, any roots that may be growing too high up on the stem should be cut off, leaving 6 to 8 inches of the stem clear. Plant out in holes prepared for them; these should be about 18 inches in diameter. The soil in the centre of the hole should form a little conical heap, the point of the heap being about an inch below the surface. Place the bottom of the plant on the centre of the heap, and spread the roots equally all round; then put in a couple of spadesful of soil over the roots, and tread firmly. Put in the rest of the soil, and tread again, being careful not to put the plants in too deep.

Cultivation.

The after cultivation of the plants will be ploughing with a small plough between the rows, throwing the furrows up to the plants. In this way you will leave a furrow down the centre to carry off surplus rain; this should be done before winter. Plough the reverse way in spring, and harrow; this leaves the ground perfectly level again. The horse hoe will require to be run up and down a few times during the growing season, to keep the soil open and to destroy weeds.

PRUNING.

The three or four branches on the young plants should be shortened back to 2 or 3 inches from the stem, and the following year they should be cut back again, leaving about one-third of the young shoot. In pruning back the main branches, always cut to an outside bud, as the plants are of an upright habit of growth. For the third and succeeding years, the pruning will be much the same. Keep the centre of the bush clear of all surplus growths, and as the bush develops allow more branches to grow; see that they are well spaced, and do not overcrowd each other.

Red and white currants keep a long time on the bush after they are ripe, if the birds leave them alone, so that the marketing of the fruit can be spread over several weeks. The best varieties are La Versaillaise, Bertyn's No. 9, Houghton Castle, and White Dutch. White currants do not sell so well as the red; the latter should be planted in much greater quantities than the white.

The fruit of the black currant requires to be picked as soon as ripe; if left too long it drops from the bush. The best varieties are Black Naples, Carter's Black Champion, and Lee's Prolific Black.

FRUIT PRESERVING.

Miss A. Mendoza, Fruit Preserving Expert.

The preserving of fruit is, perhaps, one of the most simple operations in domestic economy. yet few people care to undertake it without some little instruction, and it is with a view to providing this that these brief instructions are written.

Bottles.—All fruits may be preserved in bottles or tins. The selection of bottles is a matter of importance, as there are many faulty kinds on the market. Their defects sometimes render the whole operation abortive. For example, when they are made of badly-tempered glass, the bottoms drop out when heat is applied, generally when the lid is being put on; and again, in others, owing to badly-fitting lids, the exclusion of the air is impossible. Glass, when heated as in fruit bottling, warps in cooling; the pressure on the rubbers when the lids do not fit is therefore uneven, and the air is admitted. As the contents of the bottle cool, a vacuum should be created; without this, the preservation is imperfect, and may cause mould or fermentation.

The following particulars of the bottles illustrated will be helpful to those desirous of engaging in fruit preserving. The numbers are those indicated on the plate. It is interesting to know that, of the bottles enumerated, Nos. 1, 2, 3, 5, and 8 are made at the Melbourne Glass Bottle Works; Nos. 6 and 9 are also colonial products.

1. Atlas—Quarts and Pints.—This bottle is made with a wide mouth, in order to take large whole fruit. A good bottle for any purpose, and excellent for show work.

2. Chicago—Half-gallons, Quarts, and Pints.—A good serviceable bottle for all purposes, and when made in white glass is excellent for show

purposes. It has a fairly large mouth, which admits of the fruit being well packed.

3. This is the old English fruit bottle, with cork stopper; and, for small fruit, such as cherries, gooseberries, currants, &c., is very suitable. The only drawback is the cork; but supplies are procurable from any cork merchant. The bottle is cheap, and easily manipulated.

4. Canton—Half-gallons, Quarts, and Pints.—This is an American bottle. It is a good clear white glass, and well tempered. It has a very pleasing look, but the mouth is somewhat narrower than Nos. 1 and 2. The Canton bottle is expensive, and for domestic use is no better than any other, although its beautiful clear glass commends it. It is not always procurable, being imported in limited quantities only.

5. Mason.—This jar is made in all sizes, and is so well known as to require no special description. It is the cheapest, and said by some to be the best bottle in use.

TYPES OF BOTTLES USED FOR PRESERVING FRUIT.

6. Commonwealth. — This is a good wide-mouthed and serviceable bottle for all purposes.

7. Is a class of bottle used largely in England. The New Zealand fruit preserving expert, who kindly supplied the specimen illustrated, speaks highly of it. As far as I am aware, it is not procurable in this State.

8. Mason's Improved.—This bottle which resembles the Atlas somewhat in shape, is a good kind. The improvement consists chiefly in the method of fastening the lid; the glass top is laid on, and a screw band draws it down, so that no metallic substance can come in contact with the fruit.

9. Lightning.—This resembles No. 2, but has a much narrower top. The bottle is a good one, but not so convenient for packing as some of the others. It is colonial made, and somewhat largely used.

10. This is an imported jar, wide-mouthed, and good for preserving whole fruit; but my experience leads me to say that it is defective in the tempering, as a large percentage breaks during the heating process. It is not largely used, on this account.

11. This jar was sent from England to show the method of bottling there. It will be noticed the lid is tightened down with a clamp, by means of a worm cast in the glass; the mouth is small, and there is no improvement in any way on the ones already described.

Rubbers.—These also are at times faulty. As a rule, cheap, inferior rubber, or composition, is employed, and when the necessary pressure is applied, as it should be, whilst the fruit is hot, all elasticity is taken out of the rubber, and it fails to act as intended. In all cases the best quality of rubber should be employed.

Fruits.—Apricots and peaches are best prepared by removing the pith or stone, the fruit being cut with a sharp knife to avoid tearing. If desired, the fruit may be preserved whole, by cutting half-through and removing the stone. The cut will then close up, and the fruit present a whole appearance; but much more fruit may be placed in the bottles, or tins, when cut in halves than when whole, and for all purposes, except

BOTTLING BEFORE STERILIZING.

appearance, this method is more convenient and profitable. Plums require no other preparation than cleaning by rinsing in cold water. Apples, pears, and quinces should be pared, cored, and cut in sizes to enter the bottle. When peeled or cut, they should immediately be dropped into a brine (about 1 lb. of salt to 1 gallon of water), and allowed to remain until all are ready for bottling. This prevents oxidation or discolouration. The fruit may be afterwards rinsed.

Methods of Preserving.

Bottling before Sterilizing.—There are two methods of sterilizing. The first is to fill the bottles with raw fruit, as shown in the above illustration. Pack the fruit well, then fill up the bottles with cold syrup or water, and sterilize by placing in a bath of water or steam. If water is

employed, place the bottles in a boiler, fill it with water to the neck of the bottles, and bring to a boil. Continue to boil until the fruit is sufficiently cooked for table use, when the lids, corks, or stoppers should be fastened down whilst the bottles are standing in the boiling water or steam. If the fruit has shrunk in boiling, one bottle may be taken out and the others filled up from it whilst boiling; if this is not done, boiling water or syrup should be poured in until bottles overflow, by which means any scum or air bubbles which may have risen to the top are floated off. If the bottles are lifted out whilst hot, care must be taken to stand them on a wet hot cloth, and, by covering up until cold, prevent cold draughts striking them. Most people allow the bottle to cool down in the bath, which is the safest plan.

The second method is the steam bath, which consists of placing the bottles, when full, in a boiler or copper, standing them on a board which may be termed a "false bottom." This board should be kept an inch or two from the bottom of the vessel, which contains water to create steam for cooking the fruit. The bottles should not stand in the water, but above it, on the false bottom. The lid of the vessel should be put on. In cases where the ordinary washing copper, or any open vessel, is employed, a coarse close cloth, such as a corn-sack, may be thrown over it, so as to confine the steam. This system is much more convenient than the water bath, as the cover can be removed and the contents examined, and, if not sterilized, it may be again covered up and the process continued. There is much less heating power required, the changes are easily effected, and the work is carried on continuously. The treatment of the bottles is similar to that of the water bath. These two systems of sterilizing are usually employed when appearance is a consideration, as the fruit can be packed in all manner of ways to suit the taste of the operator.

Open Pan System.—For domestic use, the open pan system, illustrated below, answers equally well, and saves trouble. Place the fruit in a stewpan, and boil in syrup or water, as if for table use, but slightly undercook. Then stand the bottles in a vessel containing hot water, ladle out the boiling fruit, and fill the bottles. This may be done with a wire ladle, so as to take nothing up but the fruit. The bottles are then filled up with clean, bright, boiling syrup or water, and the lids fastened down immediately. Several lots may be boiled in the same syrup, which is equally good for placing in the bottle, if desired; but fresh, clear, bright syrup gives a better appearance. This system is simple and effective.

The following points must be carefully observed:—The bottles must be quite full before the lids are fastened down. The lids must be properly fitted, as described, and sterilized, before being placed in position, by dipping them in boiling water or some preservative; hot water is simplest and best. The rubbers should be served in a similar way. The lids should be fastened immediately the boiling syrup or water is poured in. Each bottle should be filled up and shut down separately. In no case should the temperature in any portion of the inside fall below 180 deg. F. before being properly closed down. Neglect in this respect is accountable for most of the disappointments met with by amateurs and others.

Syrup.—Sugar plays no part in the preserving, and is used for flavoring only, and the strength of this must be regulated by the taste of those by whom it is to be used. Fruit preserved in syrup is termed dessert or table fruit, whilst that put up in water is known as pie or culinary

fruit. Both are equally preserved, and serve the purpose for which they are intended. The syrup usually employed is made by boiling in the proportion of one pound of sugar to one quart of water. Bright cane sugar is the best; it should be boiled for a short time, and the floating scum skimmed off. The syrup may be made in bulk, and kept for use as required. Refined or loaf sugar will give the best results, and is very little more expensive; filtered water, if available, should be used. With loaf sugar and filtered water, no boiling or skimming is required beyond sufficient to thoroughly dissolve the sugar.

Bottled fruits should not be exposed to strong light when stored, as it has a bleaching effect and destroys the colour. If kept cool, they will retain their flavour better than when stored in a high temperature; but when properly sterilized, and the air is excluded from the bottles, no

OPEN PAN SYSTEM.

further change can take place, so far as the preserving is concerned, and all depends on the effective manner in which this has been done.

Canning.

This system of preserving is not generally employed by householders, but immense strides have been made in factories, both in preserving vegetable and animal products. The cost is much less than in any other method employed, and tins are more easily handled than glass. The difficulty of soldering up the tins appears to be the objection, but very little practice overcomes this. Fruits may be put up in tins in the form of pulp, jam, or preserves. The preparation of the fruits is similar to that of bottling. The tins are filled with fresh fruits and packed firmly, the syrup or water is added, and the stud soldered down, leaving the vent open. The tins are then placed in the boiler, and boiled similarly as in bottling. When partly cooked, the vent is soldered up, and the tins reboiled. The time required for boiling is regulated by the size of the tin, and also the kind of fruit under treatment. A little experience will soon

show what is required in this respect. For preserves the usual-sized tin holds about two pounds. In pulp all sizes are used; ten pounds is, however, considered the best. For jam all sizes are employed. Where the soldering difficulty can be overcome, tins will be found less costly and more convenient. Solder and soldering solution can be obtained at most ironmongers', whilst 2-lb. tins may be purchased at about 12s. to 14s. per gross. Bottles with the same capacity cost from £3 to £5 per gross.

These brief instructions are intended for the amateur only, and space will not permit of details being gone into. Information of this class is much needed, and the subject may be treated more fully later on. It is hoped that the advice given will help those who desire to give fruit-preserving a trial.

Pulping for Domestic Use.

The pulping of fruits is one of the simplest of all operations, and will be found an easy method of providing cheap and wholesome fresh fruits of all kinds. Pulp may be used for culinary purposes or jam-making whenever required. The pulping consists of simply boiling any kind of fruit which can be used for jam-making or any other methods of utilizing fresh fruit. The fruit is placed in a boiler without water, or, at least, with just sufficient water to cause the juice to run so as to stew the fruit in its own moisture. When boiled sufficiently soft, not necessarily to a pulp in the ordinary sense of the term, but sufficient to sterilize it, it can be placed in bottles in the manner described for the open pan system of preserving. Nothing in the way of sugar or other matter is added to it.

DESTRUCTIVE BIRDS.

C. French, junior, Assistant Government Entomologist.

Amongst the losses the farmer, poultry-keeper, and orchardist have to contend with in this State are the depredations committed by destructive birds. In farming districts numbers of the eagle and hawk family of birds (*Accipitres*, birds of prey) cause considerable losses by their destruction of valuable poultry. The following birds are the chief culprits, namely:—Collared sparrowhawk (*Accipiter cirrhocephalus*), black-cheeked falcon (*Falco melanogenys*), brown hawk (*Hieracidea berigora*), swamp hawk (*Circus gouldi*), whistling eagle (*Haliaster sphenurus*), &c. In various parts of Victoria, especially in the Mallee district, the wedge-tailed eagle, or eaglehawk (*Uroætus audax*), is very destructive to young lambs. Crows, like the last-mentioned bird, are a source of anxiety to sheep-owners, for when lambs have fallen, owing to weakness or other causes, the crows pick their eyes out. They are also fond of all kinds of eggs. Though a destructive bird, the crow has also its good qualities, as it consumes immense numbers of that dreaded pest, the locust.

In the fruit-growing districts the orchardists have much to contend with, not only with our indigenous birds, but also the introduced ones. The starling (*Sturnus vulgaris*), for example, is a most pernicious enemy to the fruit-grower and viticulturist in this and other Australian States. These birds are increasing many times faster than their natural food. The principal fruits destroyed in Victoria by the starling are as follow:—Peaches.

pears, cherries, apricots, grapes, apples, tomatoes, &c., &c. The English blackbird (*Turdus merula*) is another introduction from Europe. There it is looked upon as insectivorous; but here, like the starling, it has taken to eating fruits. In and around Melbourne it is now difficult to get ripe figs, grapes, and peaches, owing to the depredations of the blackbird and its ally, the thrush. The house sparrow (*Passer domesticus*) and Indian minah, or mynah (*Acridotheres ginginianus*), are also introductions. The former bird is particularly fond of figs, grapes, and other soft fruits. The house sparrow, to the farmer, needs no introduction, as its depredations, are, unfortunately, only too well known. It eats quantities of wheat soon after it is sown, and, as the grain ripens, flocks of sparrows may be seen clinging to the ears of grain, whilst they pick out the corn.

Many parrots, parrakeets, and cockatoos are also very destructive to grain, the great sulphur-crested cockatoo, or white cockatoo, probably being the worst offender in this respect. In our own State we unfortunately possess a fair number of fruit-destroying birds, and most of the orchardist's time is taken up in the endeavour to protect his fruit. Many devices have been tried to destroy these birds, but up to the present they have been almost failures. The olive-backed oriole (*Oriolus viridis*) causes a considerable loss to the orchardist by destroying a number of the softer varieties of fruit, such as peaches, grapes, strawberries, pears. That beautiful bird, the satin bower bird (*Ptilonorhynchus violaceus*), found principally in the heavily-timbered forests of Gippsland, destroys all kinds of fruit and the young plants of many vegetables. Several species of honey-eaters belonging to the genus *Ptilotis* are especially fond of fruit, grapes and figs being their particularly favoured fruits. The Australian minah (*Manorhina garrula*) is found in nearly every part of the State, causing considerable damage to the softer kinds of fruits, such as peaches, figs, grapes, &c. Honey-eaters usually feed on honey, which they extract from the Eucalyptus blossoms; but when soft fruits are ripe they are, however, very destructive in orchards. Many other birds, such as the warty-faced honey-eater (*Meliphaga phyrygia*), wattle bird (*Acanthochæra carunculata*), friar bird (*Philemon corniculatus*), Rose Hill parrakeet (*Platycercus eximius*), musk lorikeet (*Glossopsittacus concinnus*), and others are also causing immense losses to orchardists.

The white-backed crow shrike, "Magpie" (*Gymnorhina leuconota*), in some localities, especially in the Myrniong district, is accused of doing a certain amount of damage by eating the young crop as soon as it appears above ground. A friend of mine informs me that one day he counted 23 busily engaged pulling up wheat which had just come above ground, and it was with difficulty that the birds were driven away. Although this splendid insectivorous bird may occasionally destroy a little grain, it would be a sin to shoot it, as it is, without a doubt, the farmer's friend, as its chief food consists of grasshoppers, grubs, crickets, and a host of other injurious insects.

It is not often that birds such as canaries hanging in cages, are destroyed by other birds, but in some of the country districts in this State it is impossible to hang a canary outside in a cage, owing to the butcher bird, or Derwent jackass, which is a persistent destroyer of these little household pets. At Clayton, near Oakleigh, a friend of mine lost four canaries in one afternoon through these birds.

Fortunately for us in Victoria, we have very few birds that damage trees, the only ones I know of that are at all troublesome being the Gang

Gang cockatoos (*Callocephalon galeatum*). On the Alps many of the limbs or branches of the "snow gums" (*Eucalyptus pauciflora*) are eaten nearly through, and dying, the cause of this being that the trees are attacked with the larva, or grub, of a Longicorn beetle (*Tragoceras lepidopterus*), and birds then tear the wood away to get at the grub. The white cockatoo (*Calopsittacus galerita*) and the black cockatoo (*Calyptorhynchus funereus*) are also fond of beetle grubs. On the Murray, Dandenong Ranges, and other parts of Victoria, many trees, such as the red gum (*Eucalyptus rostrata*) and giant eucalypt (*Eucalyptus amygdalina*) can be seen with fairly large holes torn out of the branches and butt, showing the trouble these birds must go to to obtain one of their fancied foods.

In New Zealand the kea (*Nestor notabilis*) attacks living sheep for the purpose of tearing out and devouring the kidney-fat, and inflicts injuries which prove fatal.

NOTE.—This essay was awarded silver medal at the Geelong Nature Study Exhibition, Easter, 1906.—*Editor.*

GARDEN NOTES.

J. Cronin, Inspector Vegetation Diseases Acts.

The Azalea.

The Azalea is a dwarf evergreen shrub, found native in China and India. The present types have been raised during the past century by hybridizing *a. Indica* and other species, the garden varieties being a great improvement on the original species. A large group of deciduous shrubs, natives of North America and the Caucasus, were, until lately, classed as belonging to the same genus, but are now included with Rhododendrons. This group is known to gardeners as Ghent Azaleas, from a town in Belgium, where they were largely grown when first introduced, and where many fine varieties were raised from seed. A few varieties of this class are cultivated in Victoria, but not as extensively as they deserve. They would be likely to thrive in the hilly districts of this State, where, in places, the Indian varieties are satisfactory. At Taylor and Sangster's nursery, Upper Macedon, a large collection of Azaleas has been planted in open beds, and the plants grow and flower splendidly. A more limited collection as regards varieties is to be found at Sir Edward Holroyd's residence, at Wandin; the kinds grown are chiefly the hardier single varieties, many of which are now fine large specimens that are a mass of beautiful bloom in Spring. These plants are never watered artificially, and do not appear to suffer in consequence, although other plants considered much hardier fail to thrive, owing to lack of moisture in summer. The aspect is easterly, the soil deep and porous, and by no means peaty—a supposed necessity for these plants. The fine bed of Azaleas at the Melbourne Botanic Gardens is grown in ordinary sandy soil, sheltered by palms and tree ferns growing amongst them, and also by a breakwind of large trees growing at some distance from the bed. Most of the plants in the metropolitan nurseries are grown in pots under trellis shelter, though in some places they succeed equally well planted out in beds under the

same shade conditions. Azaleas are plants worthy of a deal of care and attention, as they produce abundance of flowers of pure, bright, and graceful appearance that last well on the plants, or when cut for decoration, a purpose for which they are eminently suitable.

SOIL AND CULTURE.

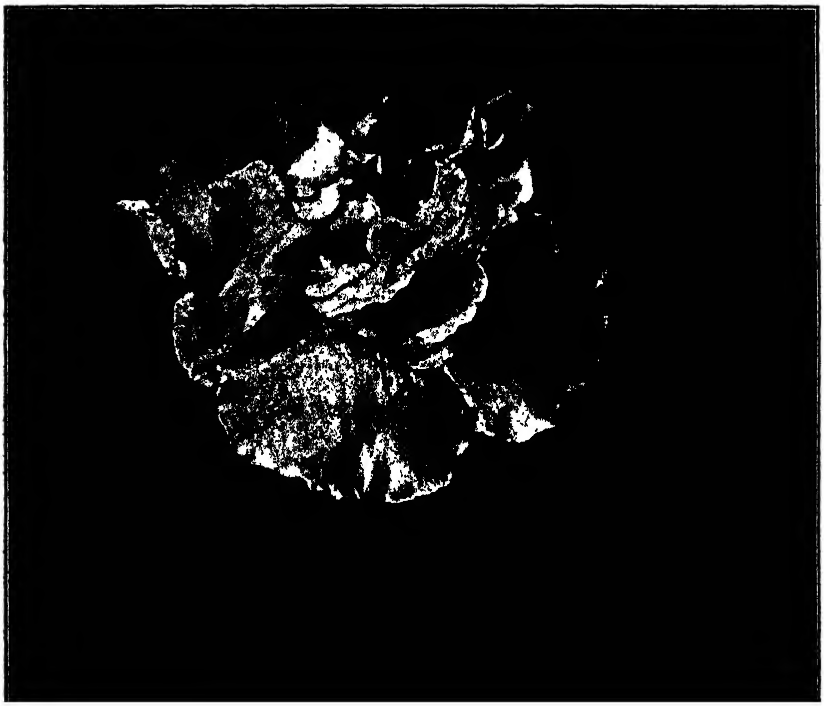
The most suitable soil for Azaleas is a sandy peat, but any porous, well-drained virgin soil, that does not contain much lime, will suit them if the aspect is right. Azaleas resent lime, and manure, and the principal reason for failure is that they are planted in old garden soil, heavily impregnated with manure, lime, and carbonic acid. Another common cause of failure is deep planting. Azaleas are surface rooting, and should,

CHARLES DE BUCK."—SINGLE, BRIGHT-ROSY PURPLE.

when planted out, be placed rather above than below the mean level of the bed. The soil should be trodden firmly to prevent any settlement afterwards, and the bed thoroughly drained. A position sheltered from hot winds should be chosen, and low positions, where the effect of frost would be severe, avoided. Spring is the best time to plant if a good supply of water is available; otherwise, autumn is most suitable. Plants from pots may be set out at any time, excepting the cold winter months. The plants need careful watering until established, and may be mulched during summer with leaf mould or some such material. A mulch of fermenting manure would probably kill the plants. Azaleas require little pruning, shortening gross shoots to maintain the balance of the plant being all that is needed

usually, and thinning when in bloom, if the plants are becoming too thick and crowded. Azaleas are suitable plants for pot culture, requiring only moderate pot room. The best potting soil is a peaty, sandy, soil, and especial care should be taken to make the drainage perfect. They should not be repotted until the pots are full of roots, and then should be transferred to pots one or two sizes larger. Very firm potting is necessary; the soil should be rammed firmly around the ball with a blunt stick. Repotting should be done when the flowering season is past, and young growth commences in Spring.

Thrips and green fly are the insect enemies of the Azalea. An occasional spraying with "nikoteen" will keep the plants free from both.



"NIOBE."—DOUBLE, PURE WHITE.

Plants in pots should be frequently syringed or sprayed, especially after being repotted. Free use of the syringe or hose will keep the plants clean and healthy.

Azaleas may be propagated from cuttings and layers, but the amateur grower would not be likely to succeed without glass frames and other facilities. The plants are fairly cheap now, indeed very cheap, considering the time and attention necessary to produce them. The principal varieties are as follow:—

Single—Fielder's White, La Victoire, Ella, Charles de Buck, Pluto, Charmer, Dandyana, Duc de Nassau, Eugene Mazil, Apollon, Marquis of Lorne, Stella. Double—Niobe, Princess of Wales, Deutche Perle (the

best double white for floral work), Phœbus, Baron N. de Rothschild, Souvenir de Prince Albert, President R. de Smit, Empress of India, Veronica, Daphne, Fortiana, Jubilee, A. Borsig.

There are also a number of small flowered kinds, hybrids, from *a. amœna*, that are very useful for floral work and decoration.

Flower Garden.

The work of pulverizing the surface is the most important phase of gardening this month. The hoe should be kept going as much as possible, even if no weeds are present, especially after rain and as the surface is drying. In addition to the benefits secured to the plants by aerating the soil and conserving moisture, the work of maintenance is made much easier and generally more of a pleasure than a toil. All plants that require staking should be attended to as need arises. At best it is difficult, and the result more or less unsightly, to have to pull and tie plants upright that have been allowed to become set in a recumbent position. Growing shoots on climbing plants should be tied in the direction required to fill space, and not be permitted to cross and interlace each other. Rapid growing and shy blooming plants should be trained more to the horizontal than the upright.

Summer flowering annuals should be thinned out if too crowded, and the plants kept growing as freely as possible. A mulch of stable manure or a watering with liquid manure will increase the size of the plants and enable them to produce a much greater quantity of, and far finer, flowers in due season. Asters, Phlox Drummondii, and other free-growing annuals should have plenty of room allowed each plant; if planted in clumps, from 6 to 9 inches between each plant. The season of flowering will be prolonged by cutting the flowers regularly in the case of many kinds. Corms of Gladiola may be planted. It is not advisable to keep bulbs, &c., out of the ground too long after they begin to shoot. A deep well-enriched soil is necessary to produce fine flowers. In case of early-planted corms, the plants will now require to be staked and liberally watered as the flower spikes appear. Bulbs of Hyacinths and Tulips, and Anemone and Ranunculus Crowns should be lifted after the tops die down.

Tender annuals, *i.e.*, those that will not resist frost, may be sown where they are to bloom, or in pans or boxes for transplanting. A number of kinds are worth growing for their foliage, and may be planted in large borders in proximity to such bright flowering plants as Salvia Bonfire. Some of the Amaranthus have foliage of various shades of yellow, red, and green, and of most variable form.

Attention should be paid to the destruction of insects and fungi. No quarter should be given, and no time lost in making the attack. But it is necessary to know how and with what to spray or wash the plants, and every reader of this *Journal* should, with that end in view, procure a copy of the *Pests and Diseases Chart* issued gratis by the Department.

Kitchen Garden.

Keeping the young growing crops free from weeds and the soil in a condition of good moist tilth are most important at present. Frequent hoeings are beneficial to the crops, and prevent weeds, which is far better than permitting them to grow and then destroying them.

As crops of various vegetables are gathered, the land should be dug again and manured in preparation for other crops. Rotation should always be kept in view, and crops as varying in character and needs as possible be sown or planted in succession. This will tend to the production of healthier and better plants, less weeds of certain types, and is the only possible way to cope with many of the insects and diseases which affect vegetables. It is the accumulation of diseases from many crops of a certain type or character, that, under favorable conditions, cause great destruction. Short rotations of various crops grown avert this accumulation in a great measure.

Seeds may be sown of Celery, Cabbage, and other vegetables for winter use; and Peas, Beans, &c., for succession. Plantings may be made from former sowings. Tomatoes should be tied to stakes or trellis as growth advances, and any side branches that occur removed.

HOW TO SAVE THE BEST TOBACCO SEED.

Temple A. J. Smith, Tobacco Expert.

Where it has been proved that a certain type of tobacco thrives best, and gives the best return to the grower, every effort possible should be made to still further improve that type, or, at least, to preserve its best qualities. This can be done most effectually by the selection, for seed purposes, of those plants in the field showing the truest relation to the type desired, and by securing the strongest and best possible seed from each individual plant. In order to do this, it is necessary to study the different qualifications of each type. Having fixed a standard, the grower must keep to it for several years, otherwise his results will not be satisfactory; that is to say, if the same standard is not adhered to in the main, uniformity cannot be secured in the crop, and this is one of the most important features in the production of tobacco leaf.

The following points should be well considered before finally deciding which plants should be retained for seed:—

Purity of type and seed;
The size, shape, and number of leaves on the plant;
Uniformity in type, shape, and ripening;
Size of mid-ribs and veins, and their position in the leaf;
Early ripening and curing properties;
Easy working in regard to suckering, &c.;
Suitability to soil and climate;
Healthy, vigorous seed.

The best method to follow in order to get the purest seed is to grow the seed plants some distance away from the main crop, say, a mile, if possible, and to confine each plot to only one variety. In this way the danger of cross fertilization is avoided. This system, however, can only be carried out on large holdings. Where it is necessary to save seed from plants close to other tobaccoes in the field, special precautions must be taken.

The tobacco plant is self-fertile, and the seed saved from plants self-fertilized has been found more vigorous than from those cross fertilized with the same variety. The means to be taken to prevent hybridization are simple. Just before the flower shows the central cluster of buds, it

should be enclosed with a muslin bag, which is tied round the stem sufficiently tight to prevent insects crawling through, but not so tight as to pinch the stalk. In some cases paper bags are used, but muslin, or some other light cloth covering, is best. All the lower branches on which seed pods form, together with all suckers and the top leaves, should be taken off, and only the main central cluster of buds left on. By so doing, the strength of the plant will not be overtaxed. The smaller quantity of seed produced will be heavier and better, and a larger proportion will germinate. The bag should be removed from time to time on a still day, and suckers taken off, also any pods that are attacked by grubs, and all the small, immature pods. Insects and wind will both be found causes of cross fertilization, and due caution should be taken to prevent their doing damage while the flowers are exposed. When the bag is replaced, it should be tied slightly higher up the stem to allow for the development of the pods. The bag is left on until after the plant is cut and the seed dried out.

About ten of the lower leaves should be left on the plant, and these are removed as they ripen. When the seed pods are fully matured, the stalk should be cut low down, leaving the bag still on, and taken to the shed, where it should be hung well above the floor in a place where the air circulates freely, until sufficiently dry to thresh. Every plant saved for seed should be labelled, its special qualities noted down, and the label left on the stalk until the seed is threshed, when it should be tied on to the bottle in which the seed is placed.

In studying the number of leaves, shape, texture, ribs, &c., much will depend on the purpose for which the tobacco is to be used, and the class and type to which it belongs. If for filler purposes, the texture, vein, and appearance is not considered to the same extent as for wrapper, neither is the shape of so much importance, but a good filler leaf must have good flavour, aroma, and ash, with the minimum amount of mid-rib and good burning quality. For wrapper, which is the higher priced leaf, the shape should be such as to allow of cigar or plug wrappers being cut to the best advantage from each half-width of leaf. The broader the leaf in proportion to length, the more useful and valuable it will be to the manufacturer, as he will be purchasing less mid-rib as compared with the workable portion, and can, therefore, afford to pay more for a wide, than a narrow leaf. The proportion of mid-rib to the blade of the leaf varies from 24 per cent. to 33 per cent., and when it is remembered that the mid-rib is waste tobacco for smoking purposes, the advantage in growing wide leaf is obvious. A leaf that widens rapidly at the butt, and has a round point or tip, will contain much less rib in proportion than the long, narrow leaf with tapering ends. For cigar wrapper especially, the leaf should be silky, of fine texture and elasticity, and good colour. To obtain the fine texture, it is sometimes advisable to grow as many leaves as the plant will comfortably mature. Therefore, the plant that produces a large number of leaves is one that should be saved for seed for wrappper tobacco, provided other qualifications are present. When a plant produces leaves with the lateral ribs close together, or at very uneven distances between, it should be avoided. Sometimes two lateral ribs, or veins, will start together from the mid-rib, branching out as they near the outer edge of the leaf. Such a condition indicates deterioration of seed, or starved growth, and leaves so formed never make the best wrappers.

Plants of the same variety that grow a large number of leaves will often be found growing beside those that produce only a few. It is almost always best to choose the plant that grows the greater number, as by pruning off the top and bottom leaves, greater uniformity can be obtained, and a larger quantity of high-grade leaf secured. Some plants ripen more evenly than others. That is, the leaves all ripen together. This is an advantage, as the cure and sample will be better. Early maturing plants save labour and risk, the differences being very marked. Some plants will ripen in from twelve to sixteen weeks, others taking as long as twenty-two weeks; that is, from the time of transplanting. The saving of a month's work in the field is well worth trying for, while the risk of loss from frost, hail, wind, &c., is minimized. Quickly grown tobacco is always best. Plants that grow the leaves without a frill, or lug, round the stalk or butt of the leaf are more easily suckered and stripped than those that do, and there is less cover for grubs, moths, and thistledown. A fair distance between the leaves on the stalk also makes easier working. Where the leaves are well apart, a good cure is more easily effected, as they are not so bunched together in the shed.

It is not wise to save seed for general purposes from plants that have not been acclimatized, but when a variety has been grown for two years, and has proved suited to soil and climate, seed can be taken. It is important that a healthy season be chosen in which to save a large quantity of seed. If the disease known as Blue Mould has been prevalent in any one season, it is better not to save seed unless necessary. The same remark applies to other diseases, though, fortunately, we in Australia are free from many diseases of tobacco which occur in other parts of the world. One healthy tobacco plant will, if properly treated, provide sufficient seed for the planting of from 25 to 50 acres; consequently, it is not necessary to preserve a large number of plants for the grower's own use. At the some time, when in a good season a number of particularly good plants are available, an extra quantity of seed should be saved: sufficient for seven or eight years' supply is not too much. Heavy seed is better than light, and, for this reason, it is a good plan to sift the seed through a very small sieve made for the purpose. Another method is to blow the light seed away by means of a fan, regulated so as not to be too powerful. Threshing is easily accomplished by rubbing the pods when dry between the hands. After shelling the seed into a dish, it should be sifted, and then placed in jars made air-tight with screw tops, and carefully labelled with the date, name, and characteristics. If stored in a dry situation it will retain vitality for ten years.

To secure the best plants for seed, it is a good custom to save considerably more plants until near the ripening stage, than are ultimately intended to keep. By that time it can be decided which are most true to type, mature early, are uniform, easy to handle, and healthy. Then be sure to try for the smaller quantity of strong, healthy seed by taking off all the top leaves, suckers, and branches. Leave only the central cluster of seed pods, and protect from outside contamination. If every grower would undertake the selection of his own tobacco seed under proper methods, a great improvement in Victorian tobacco leaf would surely result. The time and labour necessary to do this would be very little. It is only natural to presume tobacco can be improved in quality, quantity, and value, just as maize, wheat, and potatoes have benefited by the same attention, more especially as it has been proved that individual tobacco plants are most consistent in handing down their special characteristics.

THE PROCLAIMED PLANTS OF VICTORIA.

(Continued from page 558.)

Alfred J. Ewart, D.Sc., Ph.D., F.L.S., Government Botanist; and J. R. Tovey, Herbarium Assistant.

The Water Hyacinth.

Eichhornia speciosa Kunth; syn. Pontederia crassipes, Mart. (*Pontederiaceæ.*)

A floating plant, the roots having a cap-like covering at the extremity. Stems very short, the leaves almost entirely immersed, roundish, but very variable in shape; leaf-stalks, long or short, more or less inflated below the middle, with a sheathing scale at the base. Flowering axis from 6 to 12 inches long, with several sheathing bracts. Flowers, 6 to 12, with a curved tube, pale-purple; the five lower segments nearly equal, the upper one larger, and marked with a yellow spot in a cloud of blue. Stamens inserted within the tube, 3 long, 3 short, filaments lilac, with numerous stalked glands. Anthers oblong; ovary tapering upwards into the style, stigma globular. It is a native of tropical South America. The flowers are very beautiful, and, as it flowers freely, it has been widely cultivated.

The following extract from Bulletin No. 14 (1891), issued by the U.S.A. Department of Agriculture, plainly shows the danger of allowing this plant to spread:—"Along the St. John's River the margins are lined on each side by a broad belt of plants, and all coves, marshes, and small tributary creeks are entirely covered. Sometimes the main channel of the river becomes blocked by masses of the plant. The same conditions also prevail in Florida and other districts." Proclaimed under the Thistle Act for the whole State.—October, 1901.

(To be continued.)

THE WEEDS OF LAKE WENDOUREE.

Alfred J. Ewart, D.Sc., Ph.D., F.L.S., Government Botanist and Professor of Botany in the University of Melbourne.

Great difficulty has been experienced by the Ballarat Council in keeping the luxuriant growth of the weeds of Lake Wendouree in check, and considerable expense has been incurred by them for this purpose. Numerous abortive attempts have been made in the past to permanently clear the lake, and much money spent, without achieving any permanent improvement. Recently the Council imported a fen reed-cutter from Bedford. This is a small stern-wheel paddle-boat driven by a petrol motor, and trailing on each side an iron rod, which can be raised and lowered. At the end of the rods a pair of strong cutting blades is fixed so as to form a V with the apex forwards. The cutting edge of each blade is like that of a bread-saw, and the knives are drawn after the boat in a series of jerks by the aid of a crank attachment to the connecting rod, the knives being kept a few inches off the bottom. The cutting goes on during six months of the summer, and at such times and in such places as to insure that the cut

weeds, which mostly float at the surface, will be driven to the side by the wind, so that they can be drawn ashore. In this way a certain amount of the area has been kept reasonably free of weeds during the past year, but only by a total expenditure of approximately £400 per annum, in which no allowance is made for the time of officials taken from other work.

At the request of the Council, a visit of inspection was made in August, 1906, to determine whether any means could be devised of keeping under the weeds at small cost. The more troublesome weeds growing in the lake are all flowering plants, of which specimens of the following were obtained. Only one specimen (*Myriophyllum elatinoides*) was found in flower, so that the naming is in certain cases subject to revision.

Flowering Plants.

Myriophyllum elatinoides Gaud.—Long stems, feathery leaves, spikes of minute flowers with entire small but broad leaves projecting above the water. This plant is easily kept under by cutting, and frequent cutting will ultimately practically suppress it.

Potamogeton obtusifolius Mert and Koch.—Grass-like plant, with slender creeping stems, and erect ones with long, rather narrow, thin leaves. After cutting the erect stem, the remaining basal portions, which contain a good deal of stored food, shoot at every joint, and in summer time very rapidly increase to the original size, and may even be denser than before. It can be kept under by dredging or raking off the bottom. This plant was first noticed in quantity in 1904, four years after the waste water from the reservoir was turned in, and since then has spread rapidly. Specimens of the plant were, however, sent to the National Herbarium from Lake Wendouree by Spence, in 1883. *Potamogeton natans* has oval leaves floating on the surface.

Lepilaena Preissii F. v. M. – A somewhat grass-like plant, which can be kept under by dredging or by raking mud over it. This plant and another more grass-like one appear to be diminishing. The latter plant resembles in vegetative characters *Ruppia maritama*, although it seems hardly likely to find this maritime plant so far inland in a fresh water lake, even if the water of the lake had been brackish before the supply of fresh water was increased.

Triglochin procera R. Br.—A large plant with rather lily-like leaves. A large quantity of food is stored up in the stem and roots, buried in the mud, so that frequent cutting is required before the plant is exhausted.

Vallisneria spiralis L.—In leaf this plant slightly resembles the former one, but the leaf is thinner, a darker green, less rigid, and does not project above the water, while the female flowers are on long spirally-coiled stalks. Frequent cutting soon exhausts the plant.

Villarsia reniformis R. Br.—Floating, more or less kidney-shaped leaves on long stalks. Easily kept under by cutting.

Typha augustifolia L. Reed Mace.—One of the largest of the reeds, all of which can be kept under by frequent cutting as close to the base as possible. It is worthy of note that in the fen districts of England reed-cutting is a profitable industry.

The non-flowering plants included *Azolla* (floating on the surface), *Spirogyra* (floating beneath the surface), and *Nitella* (growing from the bottom). The former plant takes the place of the Duckweed (*Lemna*) of an English pond, and is easily removed when driven to one side by the wind. The two latter plants are very sensitive to poisons. Thus, the

addition in summer time of 10 tons of crude sulphate of copper, at a cost of rather more than £150, would kill out these plants without affecting the other living organisms to any appreciable extent, but they are, unfortunately, the least troublesome weeds of all.

The fish of the lake are mainly carp and trout. They are stated to be abundant, but the weeds render fishing difficult. The lake appeared to be remarkably deficient in fresh water snails. These, when abundant, aid in keeping down the weeds, but are hardly likely to be of much service under the present conditions. It might, however, be worth while to introduce such large forms as *Paludina vivipara*, if not already present.

Points of great importance are the fluctuations of level, the amount and character of the water supply, the nature of the bottom, and whether the water is put to any use or not. In regard to the last-named item, the lake is held by the Council under a Crown grant, one condition of which is that the lake is to be kept in such a condition as to be available for temporary domestic supply to Ballarat city. The use of the water of the lake in summer time, with the bottom in its present condition, would be fraught with the utmost danger to health. At present, however, the overflow is put to no use, nor is any water drawn from the lake for domestic or other purposes.

The lake is fed partly from surface drainage and partly from the overflow from the waterworks. A sample of the latter (August 6, 1906) was very clear, left no appreciable residue on filtering, and contained 0.091 of a gram of dissolved solids per litre, including a little lime. The surface drainage water was slightly turbid, left a very slight residue on filtering, and contained 0.25 of a gram of dissolved solids per litre, in which hardly any lime was present. The clear surface water from Lake Wendouree left no residue on filtering, and contained 0.28 of a gram of dissolved solids, of which lime formed a greater part than in either of the other two residues. Since this is at a time when evaporation is reduced to a minimum, and when the overflow is greater than the inflow from the waterworks, it is evident that the water in the lake dissolves soluble constituents, partly lime, from its bed. Possibly lime may have been added at some past time, but it is evident that there is no hope of reducing the weeds by mineral starvation, by allowing only the purest water to enter the lake.

The bottom of the lake is composed of rock and boulders, covered by 3 to 8 inches or more of black mud. In the past several deep quarry-holes, up to 17 feet in depth, were excavated. These were naturally free from weeds, but are being filled up, and will soon be as subject to the spread of weeds as the rest of the lake. The denser black mud contained 18 to 21 per cent. of organic matter (dry weights), while the percentage in the soft, rich ooze ran up to as much as 45 per cent. A bottom of this character is favorable to weeds, and unfavorable to good fishing.

Another factor favouring the weeds is the maintenance of a more constant level since 1900, when the Gong-gong pipe was first turned into the lake. Before that the level often sank to 1 ft. 6 in. or less, whereas since then the summer depth is rarely less than 3 feet. In this way the natural check formerly imposed by the partial drying up of the lake in summer has been removed to a very large extent. From September, 1903, to December, 1904, the level of the lake never fell below 4 ft. 6 in. deep, and it was precisely at this time that the *Potamogeton* first became so troublesome. The rapidity with which evaporation can lower the level of the lake is shown by the fact that during January and February, 1906,

the level fell nearly $\frac{1}{4}$ inch daily, the total loss of water being 170,000,000 gallons, or rather more than the total overflow per annum.

The Problem of Weed-suppression.

The introduction of various animals, by restoring the balance of nature is often of service, but would be of little or no use here. Ducks and similar water fowl aid in several ways in keeping under certain water weeds, but at the same time by their devouring water snails and herbivorous larvæ, this effect is largely neutralized.

The cutting machine will keep under, or even suppress by frequent cutting, all those weeds which project to any extent above the water, but is very much less effective in the case of those which grow completely submerged, and these are precisely the weeds which are most troublesome at present. Cutting such forms acts in precisely the same way as mowing a lawn—the herbage becomes shorter, but thicker and closer.

Poisons.—The use of any such poisons as copper, mercurial, or arsenical salts, while extremely costly, would also involve the danger of so poisoning the lake by precipitation and surface adsorption that it might become incapable of supporting fish for some years. A method of treatment which would avoid this danger would be to allow the level of the lake to fall as low as possible, net and transfer the larger fish to a pond, and then acidify the water with sulphuric acid, followed a month or so afterwards by the addition of lime. This treatment would, however, make the lake extremely offensive for several months, the treatment would need repeating within three or four years, and would be costly. Thus sulphuric acid is fatal to water-plants in a concentration (by weight) of 0.05 per cent., which is approximately equivalent to one gallon of commercial sulphuric acid, at 2s. per gallon, in 3,000 gallons of water. At a depth of 2 ft. 6 in. the lake would contain approximately 300,000,000 gallons, and to poison this efficiently 100,000 gallons, or £10,000 worth, of sulphuric acid alone would be needed. Methods of poisoning are, in fact, out of the question, since, owing to the large number of weeds in the lake, their varied properties, and the fact that their absorbent surfaces are covered with water, only a general treatment of the above character would be of any avail, and special local treatment would be useless.

Cleansing and deepening form the only ways in which any practical permanent good can be effected. With a clean bottom and deeper water, no trouble would be experienced from weeds. If the lake were allowed to dry in summer time, and a paring plough run over it 4 to 6 inches deep, this surface material would contain all the rooted plants. Its removal would leave the bottom fairly clean, and the material could be used for raising the borders of the lake or for filling purposes elsewhere. Taking the area of the lake as $2\frac{1}{2}$ million square yards, the quantity of material to be removed would be 300,000 cubic yards, and the cost might be £10,000 or £15,000. This seems a prohibitive outlay, and would further involve the disuse of the lake for a year. It must, however, be remembered that the present outlay of £400 per annum represents, at 4 per cent., a capital sum of £10,000, and that in the past over £700 per annum has been spent in suppressing the weeds without achieving any permanent good.

A modified form of treatment which could be spread over a longer period of time, and would not involve the disuse of the lake during operations, would be as follows:—Around the edges of the lake horizontal

dredging might be carried out by means of an arrangement resembling a harvest gleaner, but with the teeth close together, and curved from side to side so as to retain the mud and weed. This could be drawn ashore by a wire rope wound by a traction engine, the dredge starting near the shore, and being carried further and further out by the steamer at each cast, until a distance of 50 to 100 yards was reached. The mud at the edge of the foreshore, when dried and faced with gravel, would form a natural embankment, raising the level of the lake. If the surface drainage from the upper end could be cut off from the lake and drained the other way, the raising of the lake level would not cause any flooding through the present drainage inlets, and the lake would gain by the purer water supply from the reservoir overflow, which is apparently sufficient to fill the lake to its highest level during winter time.

The beauty of the lake might be considerably increased by forming a couple of islands at its centre to take over the protective functions of the existing reed belt, and the material for the islands could be gained by deepening the bottom of the lake. The outline of the island would be formed by a row of piles, about 3 feet apart, and rising a foot above the high-water level. Within these a second slender row would be needed, leaving a space of about 18 inches. This would be filled with fascines of reeds, each containing a 10 to 20-lb. ball of clay or stiff mud. The soft mud and ooze obtained by dredging or pumped into this framework would soon consolidate under the pressure above if the level were kept a foot or so above high-water mark, and ultimately ornamental trees could be planted upon it.

The details and cost of carrying out these suggestions would naturally need to be determined by an engineer, but they afford the only practicable means of effecting any permanent improvement to the lake at a reasonable cost—that is, by cleaning the bottom and increasing the depth. It should be borne in mind that the existing reed-belt in the centre of the lake represents a continual source of infection as regards weeds for the rest of the lake, and that cutting the weeds without drawing them ashore increases the fouling of the bottom.

SEED STANDARDS OF PURITY AND GERMINATION.

F. E. Lee, Agricultural Superintendent.

A not infrequent inquiry made by the farmer is, "Where can I purchase reliable seed?" It is in no sense the duty of the Department of Agriculture to recommend any particular seed merchant, hence a few simple rules for the determination of the purity and vitality of seeds may be of service to persons wishing to make tests for themselves.

There are three characteristics which distinguish good seed from bad, viz.: purity or freedom from foreign matter, vitality or capacity for germinating under favorable conditions, genuineness or trueness to name and type. In order to obtain a representative sample, it will be necessary to take a small portion from at least one-third of the number of

bags, mix the whole thoroughly and weigh off, say, 8 ounces (½ lb.). Place the seed upon a sheet of glass under which is a piece of light coloured paper, then go over the sample seed by seed with the blade of a pocket knife, and sort out carefully every particle of foreign matter, consisting of pieces of stick, chaff, shrivelled seeds, foreign seeds, dirt, &c. Weigh the cleaned seed again, and the difference between that and the original weight of the sample will give the amount of impurities. For example if the sample originally weighs 8 ozs., and after cleaning weighs 7½ ozs., the impurities will be 6¼ per cent. An ordinary letter scale is useful for weighing, or, failing that, put the impurities into a small bottle and ask your local chemist to weigh them. For large seeds like maize, peas, beans, &c., a much larger sample should be selected—even 1 bushel not being too much. The United States Department of Agriculture has established the following standards of purity for farm seeds: —

Beans, cabbage, cauliflower, celery, maize, cowpeas, cucumber, lettuce, millet, oats, onion, peas, pumpkin, radish, tomato, turnip, vetch, wheat, &c.—90 per cent.

Lucerne, beet, clover, sorghum, &c.—98 per cent.

Grass seeds -90 to 95 per cent.

After the purity of the seed is ascertained, its germinative power should be tested. The capacity of seed to germinate is even more important than its freedom from foreign matter. The latter can be roughly found with the eye, but the former is impossible to even guess at. Old seed frequently retains every external appearance of being sound and healthy, whereas when sown, it may give a very poor stand. Fresh seed sometimes may also show a very poor percentage of germination, perhaps from being harvested before thoroughly ripe, or from being bruised in cleaning, or other reasons. Select one hundred seeds (haphazard) and plant them in a box containing moist garden soil. The box should be kept inside the kitchen, not close to the fire, but where the average temperature will be between 70 degrees and 80 degrees Fah. The soil in the box should be moistened from time to time, but must not be kept saturated, or some of the seeds will rot and spoil the test. An alternative method is to place 100 seeds between the folds of a moistened flannel cloth, the whole being kept between two soup plates, one inverted on the other. This latter method allows frequent inspection. As soon as the seeds have germinated, they should be removed with a small forceps or a pin, counted and thrown away. Give the seeds which appear slow in germinating every chance before deciding that they are barren. The number of ungerminated seeds will be the percentage of infertile ones in the whole bulk. It is safer and more accurate to carry out these small germination tests in duplicate, or even triplicate, so that an average may be taken. The germination standards adopted in the United States are shown on the following page. While first-class seeds usually surpass these standards, it may be said that seeds which fall as much as 10 per cent. below them need not be rejected as bad.

Before leaving the subject, a word may be said as to the importance of storing grain for seed purposes in dry places away from vermin-infested barns. Mice, weevils, and other vermin do their work in such a silent manner, that unless the seed is continually looked over, it may have

seriously depreciated when the time comes for use. The advantage of selecting plump seeds by means of mechanical graders or hand sieves. furnishes scope for an article by itself, but it may be briefly mentioned as being one of the several factors which, assisted by thorough cultivation and intelligent fertilization, insure the production of maximum crops.

Seed.	Fair percentage of Germination.	Seed.	Fair percentage of Germination
Beans	95	Cowpeas	90
Cabbage	95	Onion	85
Carrot	85	Rape	95
Cauliflower	85	Turnip	95
Alsyke Clover	80	Cucumber	90
Oats	90	Grasses	50 to 90
Pumpkin	90	Sorghum	90
Tomato	90	Lettuce	90
Red Clover	90	Millet	90
Crimson Clover	95	Peas	98
White Clover	80	Sunflower	90
Maize	90	Wheat	95

INTER-STATE STOCK CONFERENCE.

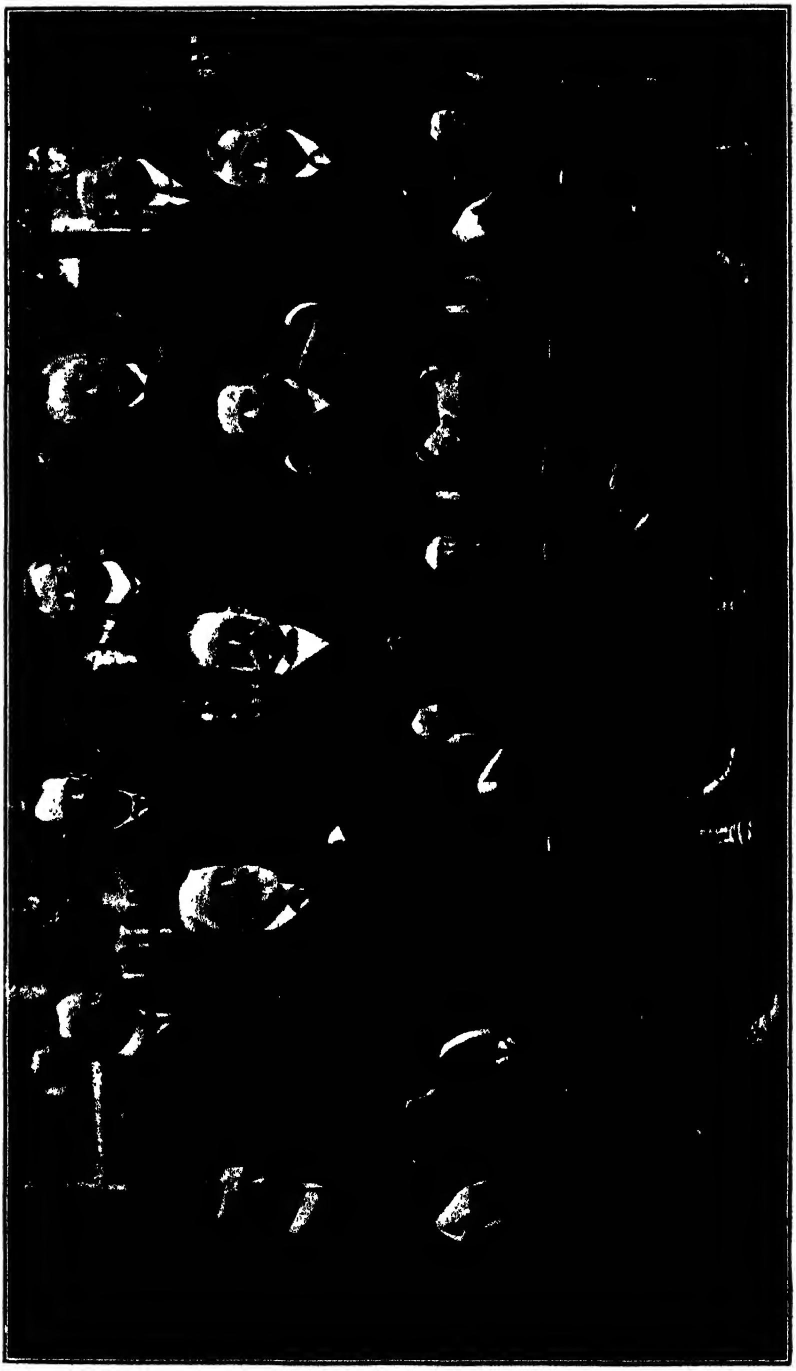
HELD AT THE PUBLIC OFFICES, MELBOURNE, FROM 28TH AUGUST TO 4TH SEPTEMBER, 1906.

Minutes of Proceedings.

The representatives to the Conference in attendance were Messrs. T. A. Tabart, Chief Inspector of Stock (Tasmania); J. P. Orr, Deputy Chief Inspector of Stock, A. H. Cory, M.R.C.V.S., Government Veterinary Surgeon (Queensland); J. D. Stewart, M.R.C.V.S., Government Veterinary Surgeon (New South Wales); R. J. Needham, Chief Inspector of Stock (South Australia); J. R. Weir, Chief Inspector of Stock, and S. S. Cameron, M.R.C.V.S., Chief Veterinary Officer (Victoria). Mr. J. C. Hatton, of the Department of Agriculture (Victoria), was appointed secretary.

The representatives were formally received and welcomed by the Minister of Agriculture (the Hon. Geo. Swinburne, M.L.A.), and by the Director of Agriculture (Dr. Cherry).

Mr. Swinburne said that he had much pleasure in welcoming the representatives to their work of taking part in a Conference which might have very far-reaching effects. They constituted but a small body of men, but a great deal of benefit might be derived from their deliberations, considering the importance of the subject which they had in hand. The main problem to be tackled was that of formulating some uniform system



INTER-STATE STOCK CONFERENCE.

Sitting—Messrs. J. P. Orr (Q.), R. J. Needham (S.A.), T. A. Tabart (T.), Chairman; T. Cherry, M.D., M.S., Director of Agriculture (V.); S. S. Cameron, M.R.C.V.S. (V.).
Standing—Messrs. J. C. Hatton (Secretary), J. R. Weir (V.), J. D. Stewart, M.R.C.V.S. (N.S.W.); J. B. Lincolne, Government Shorthand Writer; A. H. Cory, M.R.C.V.S. (Q.).

of inspection throughout the States. At the Premiers' Conference in Sydney it was felt that it would be a great pity to continue the antagonism between the States in border inspection, and that some uniformity could be established in a truly Federal spirit. It was, therefore, to be hoped that from this Conference would be evolved some good uniform system that could be adopted in every State. Up till now the various States had not seemed to have trusted each other. Victoria did not trust New South Wales, thinking that the New South Wales system of inspection was not equal to the Victorian, and consequently had insisted on having border inspectors. It would, however, be better if all the States were of the same mind, and had confidence in each other—would have such trust in each other's certificates that cattle could proceed from one State to another without that police inspection which was hardly the right thing between Federated States. Victoria was quite willing to follow the movement in this regard, which had been initiated by New South Wales, as long as she was sure that she could trust the certificates of inspectors of other States as being certificates equal to her own, and that the Departments concerned immediately notified each other what was going on with regard to diseases in stock in their own States. It was certainly the duty of these Departments to protect other States, by giving notification of outbreaks of diseases in stock. If we found the presence of anthrax in any district of Victoria, we would immediately telegraph the fact to New South Wales, South Australia, and the other States. The same thing should be done by New South Wales and the other States. A feeling of confidence in each other in that respect should be established; and he believed that if the Conference formulated a system of inspection that could be adopted by each State, and under which each Government could trust the others, and under which each State department would be a sort of intelligence bureau for the others, as to all that was going on with regard to diseases in stock, we would be able to do away with an expensive system of inspection, and have clear border traffic. Notice had recently been given in the Victorian Parliament for the establishment of municipal sheep dips, with a view to compelling all farmers to have their sheep dipped In Victoria, we had initiated a system in the Dairy and Milk Supervision Act which would be very far-reaching as far as cows were concerned, and which he thought was far in advance of anything of the kind done in most of the States. He concluded by saying that he would be only too glad to do anything in his power for the information or pleasure of the delegates.

Mr. T. A. Tabart (T.) was elected chairman, and in the name of the Conference he thanked Mr. Swinburne for his cordial welcome. He also returned thanks for the honour of his election to preside, and referred to his presidency over the Conference of 1892 in New Zealand, noting, with regret, the absence of Messrs. Bruce, Curr, Pentland, and Stirling, all dead colleagues, and of Messrs. Gordon and Valentine, retired. All these gentlemen had done excellent work in their time for the Australian States, and doubtless their successors would do likewise.

Dr. Cherry addressed the representatives, indicating the view of the Victorian Department of Agriculture with respect to the inspection of and methods adopted for the prevention and eradication of infectious diseases in stock. He trusted that the result of the deliberations of the Conference would be a definite policy, which would be adopted by the various

States of the Commonwealth, and that that policy would be for the advancement of stock interests throughout Australia.

The following Agenda paper was agreed to:—

1. Existing system of internal inspection of stock in each State.
2. Inter-State restrictions and border inspection relating to such communicable diseases of stock as—(*a*) tick; (*b*) anthrax; (*c*) pleuro-pneumonia; (*d*) swine fever; (*e*) tuberculosis; (*f*) other scheduled diseases; and (*g*) non-scheduled diseases.
3. Existing methods adopted to prevent the introduction of diseases from outside Australasia.
4. Prevention of introduction of foreign diseases.

Messrs. Needham (S.A.), Orr (Q.), Stewart (N.S.W.), and Weir (V.) explained to the Conference the existing methods of inspection and control in relation to infectious animal diseases in their respective States.

After considerable discussion, the following motion was proposed by Mr. Cameron (V.), seconded by Mr. Stewart (N.S.W.), supported by Mr. Weir (V.), and other delegates, and carried unanimously:—

That, having by responsible statements by delegates and debate thereon become familiarized with the practice of internal stock inspection in the different States, this Conference is of opinion that it is eminently desirable, as it appears also to be feasible and practicable, that a system of Inter-State exchange of reports of outbreaks of anthrax, cattle tick infestation, pleuro-pneumonia, swine fever, and any exotic communicable animal disease be inaugurated whereby all the other States may be at once notified of the occurrence of such outbreak in any State. This for the reason that while it appears to be impracticable to bring about uniformity in the system of internal stock inspection under existing legislation of the States; and because of the various local geographical and other conditions prevailing in the different States, such a system of Inter-State exchange of reports would tend to facilitate modification of the existing system of Inter-State restrictions and border inspection of stock.

Mr. Orr (Q.) made a statement indicating the measures taken in his State for the prevention of the spread of tick to uninfested areas. He said every effort had been made to stop its progress. The first line was established somewhere south of Mackay; the next south of Rockhampton; then it was grappled with at Bundaberg, and afterwards as far south as Brisbane. His Department did not throw up the sponge at the Logan River district, or until the disease had advanced as far south as the Tweed. Total prohibition without dipping was adopted. He admitted that at that time the Department did not have the desired number of inspectors available. Total prohibition had been a failure in so far as its enforcement involved a larger sum of money than could possibly be obtained. The practice now was to subject all stock leaving an infected area to two dippings prior to entering a buffer area, which is clean country. It was required that New South Wales should accept Queensland stock from the buffer areas on the certificate of the latter State's inspector, and relax the restrictions with respect to prohibition and detention of stock. He mentioned that at the crossings where New South Wales established total prohibition, the ticks got into their territory, but where Queensland cattle were allowed ingress after regular dipping no ticks appeared.

Mr. Stewart (N.S.W.).—The restrictions were due to Queensland's failure to check the onslaught, although he was prepared to admit that greater and more effective precautions are now being taken, but thought that improvement was, in a measure, due to the action of New South Wales. On the 8th March, 1904, the Chief Inspector of Stock (N.S.W.)

called attention to the fact that cattle on the Queensland side of the fence were carrying ticks, and suggested that the Queensland Stock Department should be asked whether, in the event of being given the use of New South Wales dips free of charge, they would, or could, compel owners of stock to dip at stated intervals. This, however, Queensland was unable to do. The crux of the whole position was this: Queensland must either protect New South Wales, or that State must protect itself. At the same time he desired to say that during the last year or two Queensland had made commendable efforts to assist his State, and received a promise from New South Wales that with increased vigilance they should obtain corresponding relaxation of existing restrictions. Personally, he did not consider two dippings sufficient to absolutely cleanse an animal. His opinion was based on the result of personal observation in experiments carried out during the tick onslaught. The first dipping was not considered of any value to New South Wales as it took place in an infected area. As an additional precaution, his State had always maintained that there should be a third dipping after reaching an uninfected area. Without committing his State, he, personally, would be in favour of accepting a further dipping. That was to say, two dippings before leaving the infected area, and another on reaching clean country. If this were done, he was inclined to think New South Wales would accept it, and give Queensland a reasonable relaxation of present restrictions. The only assurance he could give was that the degree of relaxation would depend on what measures the Queensland Government decided to adopt for the eradication of tick. He would be prepared to recommend acceptance of the conditions he had stated. During the discussion he had been asked for information as to the result of the second examination of stock in the Tweed River district He had referred the inquiry to the Chief Inspector of Stock at Sydney, from whom the following reply had just come to hand: "Inspector telegraphs this morning, 'Muster of all stock, including 34 horses. All clean.' I consider this satisfactory."

As the outcome of the discussion:—

Mr. Needham (S.A.) moved:—

That this Conference is satisfied with the methods adopted by New South Wales in preventing the spread of tick infestation from Queensland, and agrees that, contingent on increased precautions in certain directions to be agreed on between the two States, reasonable decrease of the period of detention in buffer areas may be safely allowed.

Seconded by Mr. Cameron (V.), and carried unanimously.

Mr. Orr (Q.) moved:—

That this Conference is of opinion that the measures adopted by New South Wales in regard to the introduction of working horses across the Queensland border are efficient and an adequate protection for the other States without the imposition of further restrictions by such States.

Seconded by Mr. Needham (S.A.), and carried unanimously.

Mr. Orr (Q.) then submitted the following further proposition:—

That in the opinion of this Conference, Queensland working horses and dogs should be admitted into Victoria by sea on similar conditions to those imposed by New South Wales.

It was seconded by Mr. Needham (S.A.), and, after considerable discussion, voted on as follows:—

Ayes: Messrs. Cory (Q.), Needham (S.A.), Orr (Q.), Stewart (N.S.W.).
Noes: Mr. Weir (V).

Mr. Cameron (V.) refrained from voting, and said he thought it unwise to pass any resolution which some of the delegates might be unable to conscientiously recommend to their Ministers for ratification. To meet that probable difficulty, he would move -

That in the event of the previous recommendation not proving acceptable to any of the States the following alternative recommendation should be substituted, namely :—That this Conference is of opinion that the measures adopted by New South Wales with respect to the introduction of working horses and dogs by sea have been proved to be effective; and that if the remaining States desire the introduction of working horses and dogs from Queensland by sea, New South Wales measures are recommended as adequate.

As this was not seconded. Mr. Cameron submitted the following motion :—

That in the event of the previous recommendation not proving acceptable to any one of the States the following alternative recommendation be substituted, namely :—That this Conference recommend that Victoria might accept *boná fide* working horses and dogs from Queensland by sea which have been subjected to the preventive measures directed against tick invasion in New South Wales; and that such working horses and dogs be landed in Victoria without further restrictions.

This was seconded by Mr. Weir (V.), and carried. Mr. Stewart (N.S.W.) refrained from voting.

Anthrax, the next subject on the agenda paper, was then brought under discussion.

The Chairman stated that Tasmania had been subjected to four outbreaks. They were promptly reported, and successfully grappled with by qualified officers.

Mr. Orr (Q.) said Queensland had no cases reported or ascertained. His State prohibited the importation of Indian bonemeal.

Mr. Stewart (N.S.W.) considered this the most important subject of the Conference, inasmuch as it was the principal means of bringing it about. On 30th October, 1889, regulations were issued by the Victorian Government to control the import of sheep from New South Wales. On 8th October, 1890, the word "sheep" was repealed, and "stock" substituted, and provision made that sheep intended for export should not be vaccinated. These restrictions were subsequently modified, inasmuch as they were in force from 1st October to 31st March only, and applied to sheep coming from a certain area of New South Wales only, which, he understood, was defined by lines drawn direct north from Wodonga on the east, and from Cobram on the west. How far they extend north had not yet been officially defined. New South Wales and Victoria were practically in the same position as regards anthrax; consequently there was no justification for Victoria continuing those restrictive regulations, particularly as they advertised that the southern portions of his State were anthrax-infected. Not only was that objectionable, but it had a depreciating effect on property as well as stock. The restrictions prevented stock-owners from taking full advantage of the Victorian markets, and caused others, whose pastures are clean, to indulge in vaccination. The New South Wales Stock Diseases Act had been in force against anthrax since 23rd February, 1904. Since that date there had been a considerable number of sheep vaccinated. The benefit of vaccination was now so generally recognised that owners of property adopted it as a safeguard. Vaccination had, apparently, been very successful in the Riverina district. No outbreak had been reported from there for some considerable time. That being so, it appeared to him that

Victoria should accept stock from New South Wales under the same conditions as New South Wales accepted them from Victoria, so far as anthrax was concerned; that was, on the certificate of the Inspector of Stock for the district. As a matter of fact, his State was in a better position than Victoria in this matter, as New South Wales stock could not travel without a permit. Their Stock Act provided a complete and efficient system of branding, and enabled the movements of stock to be traced right through the State. This system was not in operation in Victoria.

In reply to Mr. Weir (V.), Mr. Stewart stated that he had not heard of any outbreak of anthrax traceable to stock admitted from Victoria.

A general discussion followed, and resulted in the following resolution then being unanimously agreed to on the motion of Mr. Stewart (N.S.W.), seconded by Mr. Weir (V.):—

That in view of the fact that anthrax was now a notifiable disease in New South Wales, and that provision was made for compulsory vaccination when deemed necessary, the passage of stock from one State to another should be governed by the same restrictions, namely, the certifying by an officer of the Stock Departments of the respective States as to the freedom of the stock from anthrax, and, if unvaccinated, also as to the freedom from infection of the holding from which they came and of the route by which they travelled.

Pleuro-Pneumonia was the next subject brought under discussion.

The Chairman explained the regulations existing in Tasmania for the prevention of the introduction of pleuro-pneumonia into that State. Prior to 1893, prohibition was in force. In that year 130 days' quarantining was substituted. Not even under exceptional circumstances would he be prepared to recommend a shorter quarantine.

Mr. Cameron (V.) said he would like recorded in the proceedings of the Conference one or two statements, based upon sound and scientific knowledge, which would appear to show that the position taken up by Tasmania with regard to pleuro-pneumonia, and their imposition of quarantine for this disease, was not quite reasonable. He took it that the whole *raison d'être* of the Tasmanian period of quarantine was that it was a fact that a recovered beast may have a lesion in its lung encysted, and, while encysted, absolutely free from danger; but may at any time, from some lung trouble, become freed from its encystment, and, therefore, infective both to that animal and other animals. It was a perfectly sound scientific statement of fact, but there was no limit to the period of danger. It was not 130 days; it was not 130 months. So long as that animal lived, so long did that danger exist. The logical position was this: Total prohibition or a period of quarantine based upon our absolute knowledge of the incubation period of the disease, which never was beyond 90 days, seldom beyond 60, and usually within 30. So that it appeared to him the reasonable course to take, in case total prohibition was not adopted, would be to reduce the period of quarantine to—he should say—60 days; but, at all events, to not more than 90 days. This would tend to facilitate Inter-State trade, and would fully meet all the requirements of safety. He was not putting it that Tasmania should do this, or that she was not right in maintaining a perfectly clean sea-girt State; but that stock should be admitted on conditions based upon knowledge of pleuro-pneumonia, which is now almost absolute. He did not know whether, at a later stage, it would be desirable or competent for the Conference to pass a resolution in the direction he had indicated; but he did want this Conference to know what the scientific, safe, and logical position was.

Mr. Weir (V.) wished to point out that since the 130 days' regulation had been in force, cattle had been admitted from other countries, where pleuro-pneumonia was known to exist, without further restriction than 40 days.

Mr. Stewart (N.S.W.).—It seemed to him that the strongest argument for the reduction in the period of quarantine for Australian cattle was in the fact that, during the 130 days' period, no case of pleuro-pneumonia had been detected in the animals while in quarantine. It, therefore, appeared to be more due to other restrictions governing the importation than to the quarantine. In his opinion, complete protection could only be obtained by absolute prohibition.

Mr. Needham (S.A.) would like to express sympathy with Tasmania. He thought, if any of the other States were in the same position, they would be very careful about introducing Australian cattle into their State. He did not think it was fair to ask Tasmania to admit Australian cattle on the same period of quarantine as they did cattle from the United Kingdom. There was a far greater risk. He would regret to see a resolution passed by the Conference asking for a great reduction in the period of quarantine.

Mr. Orr (Q.) congratulated the Chairman on having no pleuro-pneumonia in Tasmania, and hoped that he would never have it. The aim of the Conference, however, was not to see how stock could be kept out, but, as far as possible, how stock could be admitted to other States with the least possible danger. It has been suggested that the 130 days should be reduced to something which might be considered satisfactory. Mr. Cameron has said that 60 days may, and that 90 days would, be sufficient. Tasmania has had this restriction for sixteen years, and had not detected one case, either in or out of quarantine. That was absolute proof that, notwithstanding the introduction of stock from the other States, no affected animal had got in. He thought an interchange of stock should be encouraged consistent with safety.

The Chairman said that, having heard the various arguments, he still held that total prohibition was the safest policy. As he could not get that, he obtained the longest period of quarantine possible. If this Conference were to pass a resolution to force a reduction, and pleuro-pneumonia were afterwards introduced into Tasmania, he would blame the Conference for it. He did not anticipate the Conference would take such action with regard to their quarantine regulations. He thought the present period should remain, otherwise he would strongly urge total prohibition.

Mr. Cameron (V.) said that, under no circumstances, would he be a party to forcing the Chairman's hand, and intended to refrain from submitting a resolution on the matter. Still, although no resolution was passed, he hoped the discussion which had taken place would ultimately result in a more correct attitude being adopted by Tasmania on this question.

The Chairman thanked Mr. Cameron for the position he had taken up. He was always desirous of doing all he could in the interests of commerce, as well as in the interests of the State he represented, and, while he had the honour to hold the position he did, he would always be found working hand in hand with the Stock Departments of the other States. On this question, however, he had been heckled for the last twenty years. There was an agitation now in Tasmania for a reduction of the quarantine, but if a reduction were granted, the responsibility would have to be taken by his Government, and not by him. It would have to be done in opposition to his recommendation.

Mr. Stewart (N.S.W.) stated that the disease was dealt with in New South Wales on parallel lines to anthrax. It was notifiable, and outbreaks were quarantined; infected animals were destroyed, and the remainder inoculated. Inoculation was compulsory, and no stock were allowed to travel unless declared clean.

Mr. Needham (S.A.) said that the conditions existing in his State with regard to this disease were almost identical with those of New South Wales. It had been a notifiable disease for a number of years. They had exactly the same powers to deal with it as New South Wales. They could seize cattle at any suitable place and quarantine them there. At present they had three outbreaks in the State. The cattle had been inoculated. They had only had two outbreaks in dairy herds. The way-bill system was in force.

Mr. Weir (V.) explained at length the quarantine regulations in existence in his State, and the methods of dealing with outbreaks. He admitted that Victoria was at a disadvantage in not having the power of compulsory vaccination. He thought inoculation was the best safeguard they could have in conjunction with quarantine.

After further discussion, the following motion was submitted by Mr. Stewart (N.S.W.):—

That in the opinion of this Conference it is desirable in the interests of Inter-State stock traffic that Victoria should have legislative power as now exists in New South Wales, Queensland, and South Australia, to enforce protective inoculation for pleuro-pneumonia contagiosa, and vaccination for anthrax of stock recently exposed to risk of infection with these diseases.

It was seconded by Mr. Needham (S.A.), and carried.

Swine Fever.—The outcome of the discussion on this subject was a resolution moved by Mr. Stewart (N.S.W.), and seconded by Mr. Cory (Q.)—

The importation of swine from one State to another might be permitted by special arrangement, agreed upon by the States concerned.

It was carried unanimously.

Mr. Cory (Q.) submitted the following recommendation:—

That for administrative purposes it is desirable that the term "swine fever" be taken as including any of the contagious or infectious diseases of swine of a hæmorrhagic septicaemic character now variously termed "swine fever," "swine plague," "hog cholera," and the like.

Seconded by Mr. Cameron (V.), and carried unanimously.

Incidental to Border inspection, Mr. Weir (V.) moved—

That this Conference, in view of the modification and concessions which they agreed upon as calculated to conduce to the free interchange of stock between the States, and bearing in mind that such facilities should only be granted to stock which are not merely healthy, but that they should not have been in contact with animals suffering from infectious or contagious diseases for some time previously; and as infectious and contagious diseases exist in each of the various States of the Commonwealth, it affirms and recommends that, for the better protection of stock-owners in each of the various States, and with a view to assist in preventing the stealing of stock, that a thorough and rigorous system of Border inspection be pursued, on lines calculated to safeguard the best interests of all parties interested in stock.

This was seconded by Mr. Cameron (V.) *pro formâ*, but, on being put to the vote, was declared lost, the voting being—

For—Mr. Weir (V.). Against—Messrs. Cameron (V.), Cory (Q.), Needham (S.A.), Orr (Q.), and Stewart (N.S.W.).

At the close of the discussion on *Other Scheduled Diseases and Non-Scheduled Diseases*, Mr. Needham (S.A.) moved—

That in the opinion of this Conference Victoria should pass regulations to enforce the compulsory dipping of sheep affected with lice and tick.

Seconded by the Chairman (T.). and carried.

The last two subjects on the agenda paper. viz., *Existing Methods adopted to Prevent the Introduction of Diseases from outside Australasia*, and *Prevention of Introduction of Foreign Diseases*, were taken together, at the suggestion of Mr. Cameron (V.), who thought much of the information elicited in the discussion of the latter would have a direct bearing on the former.

Statements were made by delegates from each State, setting forth the regulations for the prevention and methods adopted to prevent the introduction of disease under both these heads.

After discussing the matter in all its details, the following resolutions were unanimously agreed to:—

That it is advisable to hold ships' dogs in a properly-established quarantine while the vessel is in port.

Proposed by Mr. Stewart (N.S.W.), and seconded by Mr. Cameron (V.).

That the system of quarantining imported horses and dogs in private premises as practised by Victoria is regarded as a menace to the animal health of the Commonwealth, and should be immediately abolished, and provision made for the proper quarantining of these animals.

Proposed by Mr. Stewart (N.S.W.). and seconded by Mr. Needham (S.A.).

That in view of the magnitude of the live stock interests in Australia, which interests are threatened by the existence in India, Africa, the Philippines, the Malay States, and the East Indian Islands, including New Guinea, of the following diseases of animals, viz.:—Dourine, surra, rinderpest, South African horse sickness, nagana; and while recognising the value of the precautions now taken, this Conference recommends that importation of stock from those countries should be absolutely prohibited.

Proposed by Mr. Cameron (V.), seconded by Mr. Orr (Q.).

That the admission of cattle into the Commonwealth from countries in the Northern Hemisphere during the months of September, October, November, and December, is not desirable owing to risk of introducing the warble fly.

Proposed by Mr. Stewart (N.S.W.), seconded by Mr. Cameron (V.).

That in the event of rabies not appearing in the United Kingdom during the ensuing twelve months, the advisability of reducing the period of quarantine imposed on dogs imported from the United Kingdom should be considered.

Proposed by Mr. Stewart (N.S.W.), seconded by Mr. Cory (Q.).

That the introduction of an efficient Brands Bill by Victoria, providing for a system dissimilar to those adopted by other States, is strongly recommended.

Proposed by Mr. Needham (S.A), seconded by Mr. Stewart (N.S.W.).

That in the opinion of this Conference foreign vessels should be continuously in Australian waters for three months before being deemed clean.

Proposed by Mr. Weir (V.), seconded by Mr. Orr (Q.).

Votes of thanks were, by resolution, accorded to the Chairman (Mr. Tabart), to the Secretary (Mr. Hatton), and to the Government shorthand writer (Mr. Lincolne), for their courtesy and attention, and for the satisfactory discharge of their duties.

The Victorian delegates, Messrs. Cameron and Weir, were deputed to convey expressions of thanks and appreciation to the Minister of Agriculture, and to the Director, for the courtesy and hospitality extended to the visiting delegates.

THE ORCHARD.

James Lang, Harcourt.

Fruit trees of all kinds are looking well, and should nothing intervene, heavy crops of fruit will be assured. With good crops of apples, both here and in Tasmania, local prices will be low, and it will therefore be advisable to export to relieve the glut. From advices to hand, prices are expected to rule fairly good in the London market. To get the best price, apples of good quality and best varieties only, properly graded and packed, should be sent. The export expenses are now considerably reduced, the charge from Port Melbourne to London being 5s. 3d. per case. This includes every expense except rail freight from orchard to Port Melbourne, which is a varying amount according to the distance the orchard is from the port, but 5s. 6d. may be taken as a fair average expense per case, from orchards 100 miles from Melbourne. There is room, however, for a considerable reduction in the shipping freight, and it is to be hoped that when the new Commonwealth mail service is in operation, a substantial reduction in the freight on fruit will take place.

November will be a busy month for the orchardist. Cultivating the ground, and spraying will take up most of the time. The splendid rains of last month have put the ground in fine condition for working, and no time should be lost in getting the ground in good tilth for the summer. Spraying for black spot with Bordeaux mixture will require attention, and the peach trees affected with curl in the leaf should also be sprayed with the same mixture. The black aphis on the peach will require looking after, the best remedies being the tobacco wash and the kerosene emulsion. From Canada comes a new method of emulsifying kerosene by mixing 1 lb. lime with 1 quart of kerosene, and adding 20 quarts of water. This requires to be churned continuously for five minutes through a force pump, and it is said that it will keep the kerosene in suspension for several days. A stronger percentage of kerosene could be used for winter spraying by adding half the quantity of water. For the Codlin moth spray the trees with some form of the different arsenical sprays now in use. The spraying should be carefully done so that the whole of the tree is covered, and should be repeated at intervals of ten days. Bandages should be placed on the trees, as by this means grubs that come to maturity can be trapped and destroyed—every grub destroyed means a considerable reduction in future broods.

Newly-planted trees and trees newly grafted should be gone over, and misplaced buds rubbed off. Where old trees have been headed back the young shoots should be thinned out, leaving just sufficient to form fresh branches. Trees just grafted should have the scions well secured to prevent them being blown off by the wind.

CORRECTION.

Through an inadvertence, Mr. R. Sillett was credited with the authorship of the article on "Agricultural Education" which appeared in the October issue. The article in question was written by Mr. F. A. Cronk, President, Agricultural Society, Shepparton, and read by Mr. H. R. Gillett at the Sale Convention of the Chamber of Agriculture.—EDITOR.

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A PLEA FOR TREE PLANTING AND TREE PRESERVATION.

J. M. Reed, I.S.O., Surveyor-General.

"Jock, when ye hae naething else to do, ye may be aye sticking in a tree; it will be growing, Jock, when ye're sleeping." —*The Heart of Midlothian*, Chap. 8.

Even to the most casual observer, when travelling over a great part of the State of Victoria, the absence of tree shelter on farms and grazing lands is very evident, and it is surprising that so many land-owners fail to recognise the great importance of tree-planting. If the authorities of this State, when disposing of Crown lands, had made compulsory provision for the maintenance of timber growth, or the planting of trees on a percentage of the area of every holding, it would have been a great benefit, and if farmers could be made to realise the direct gain to themselves by meeting this requirement, much good would result. The progress of settlement has necessarily involved the destruction of an immense quantity of timber, and, as our own experience has clearly proved that rainfall conditions are largely affected by tree cover, it may be accepted that the one cannot be removed without prejudice to the other. Many predictions of ultimate disaster from the clearing of our timbered lands have been uttered, but, without accepting these, it may be asserted that nothing but good can result from generous tree propagation.

On many of the large estates in the Western District, where shelter for stock was found to be indispensable, more or less extensive tree-planting has been undertaken. Unfortunately, the blue gum was the tree most favoured in earlier years, and experience has showed it to be a decided failure. The substitution, in later years, of the sugar gum, which is now generally grown, has proved very satisfactory. Titanga estate, near Lismore, is probably the most striking object-lesson in Victoria, as showing the excellent results of systematic tree-planting. The late Mr. J. L. Currie, of Larra estate, who also owned Titanga, initiated this good work, and, appreciating its great value, made a special study of the different variety of eucalypts, of which he formed numerous plantations. The

present owner, Mr. P. S. Lang, who has for many years carried on the work of his predecessor, is an enthusiastic advocate of tree-planting, and, under his care, this tract of country, which was to a great extent devoid of timber, has been quite transformed. It now presents a most attractive appearance, owing to its park-like effects, and numerous vigorous plantations, covering an area of over 700 acres. Illustrations 1, 2, 3, and 4 apply to this estate. Another very striking illustration is that of the sewage farm of the Melbourne and Metropolitan Board of Works. When first occupied, about fifteen years ago, this property was almost treeless, and, by a well-devised scheme of planting, nearly 400 acres of well-established plantations have been formed. An experience of the Werribee Plains on a cold, wet day, with south-westerly winds, will serve to emphasise the wisdom of this action. Illustration No. 7 represents a home on the Werribee Estate; the first planting was done 13 years ago, and has been added to year by year. The owner, Mr. J. Brown, has this season planted 200 sugar gums.

1. MAIN ENTRANCE, TIIANGA ESTATE. PINE TREES AND GUMS, PLANTED ABOUT 18 YEARS.

While many owners have carefully selected and preserved good shade trees on their properties, and others have been careful to form plantations, large numbers have had but the one idea, to clear the land for present use, without any regard to future wants. Even fine shade trees on country roads have too often been ruthlessly sacrificed to the greed of the land-owner, who could not endure a light growth of crop or grass on a few yards of his land as a result of the existence of fine overhanging trees. Shire councils could render good service by resolutely protecting timber growing on roads. Along river and creek frontages, too, there has been wholesale destruction of matured shade trees, and, though distinctly illegal, hundreds of owners have assumed to themselves the right of clearing to the bank of the stream. The value of cover along the water frontages is not recognised as it should be. For the prevention of erosion of banks, and the preservation of the

purity of the water, there can be no question that protective measures are required, and a general order forbidding the clearing of river and creek reserves, unless specifically authorized, would be a wise step, and would tend to check this abuse. Though the statement may appear to be an exaggeration, it is a fact that on many of the at one time forest blocks of South Gippsland there is scarcely a green tree to be found, while on some it is now a matter of difficulty to obtain fencing material. The settler has simply destroyed all the native growth, and the sooner replanting is begun the better for the settlement.

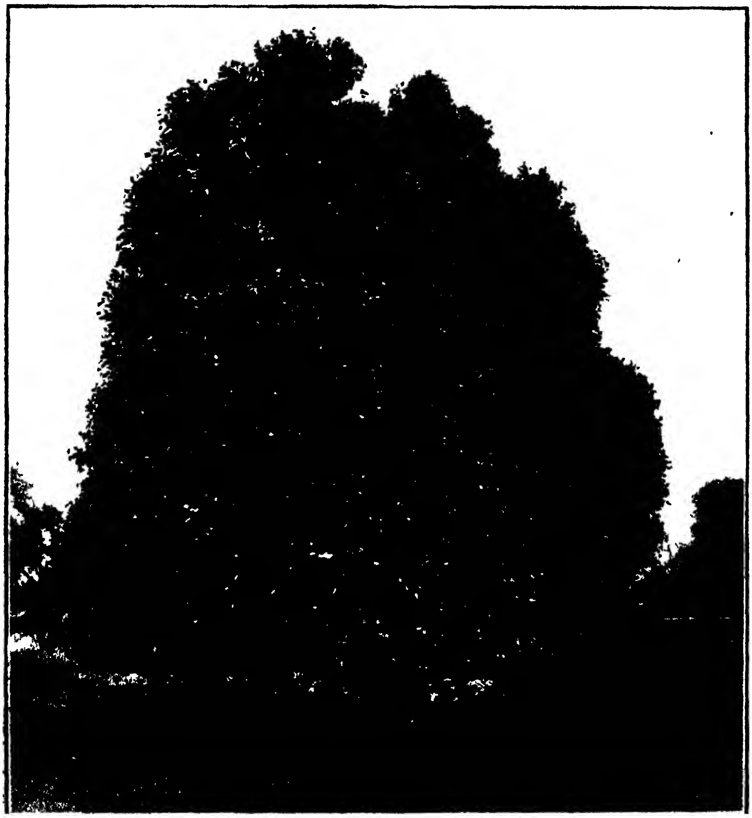
It is a great mistake to regard the land comprised in plantations as wasted. On the contrary, the value of the protection to both crop and stock far outweighs that of any area so utilized. Year by year in many districts fencing material and firewood supplies are becoming more costly, and State reserves from which they have been drawn are gradually being

2. SPECIAL PLANTATION OF DIFFERENT VARIETIES OF EUCALYPTS SOWN 1889, SHOWING FREE GROWTH OF SUGAR GUMS.

exhausted. While for the supply of towns and for the purposes of mining and other industries the State reserves must be depended on, it is certain that, unless land-owners take steps to provide for their own needs, they will in a short time experience great difficulty in obtaining their supplies, and the question may appropriately be asked: Why should the State be expected to provide for the timber requirements of those land-owners who, by a wise foresight, can themselves make such provision?

Victoria is a small State, and, as the demand for land is very pressing, the tendency must be to limit the area under reservation. Bearing in mind the small area of good land now available, and the keen competition for land for occupation, it is fairly certain that many of the existing reserves will, as they are denuded of timber supplies, have to be utilized for settlement. The proposed forest legislation will, it is hoped, result in more

effective control, and promote the development of forest lands by the closing and renewal of forests; but, no matter how effectively this may be done, there will still be the need for the work of the land-owner, and, though the individual contributions would be small, the aggregate would be great, and the benefits far-reaching. When dealing with Eurack estate, one of the properties acquired several years ago for closer settlement, the Lands Department introduced a stringent condition, requiring every settler to plant 2 per cent. of his area, or up to a limit of three acres, and this formerly



3. EUCALYPTUS ALPINA—A VERY BEAUTIFUL TREE.

treeless estate will no doubt in a few years illustrate the great advantage of tree-planting. The Land Purchase and Management Board has decided to apply this wise condition to the estates coming under its control.

In very many instances the neglect of tree-planting and the absence of shelter for stock amounts to positive cruelty. The sight of dumb animals exposed to the blazing summer heat or cold winter blasts, with no better shelter than is afforded by a boundary fence, is by no means uncommon, and the wonder is that owners do not recognise that in this they are responsible for quite unnecessary suffering, and, further, that they themselves suffer loss as a result of this lack of care for the animals on which they depend for their personal gains. Judicious tree-planting around homesteads and all farm buildings, in the vicinity of water storages, along exposed

boundary lines, in waste corners, or in clumps as screens for stock, would in a few years change the appearance of farm holdings, add to the comfort of the occupiers, give substantial profit to the owners, and invest our country lands generally with an added beauty and attraction. Illustrations Nos. 5, 6, and 7 show in striking contrast a cheerless unprotected Northern District home; a Gippsland home, with dead timber, but no attempt at home planting; a comfortable farm home, well screened by young trees.

The numerous and valuable agricultural societies in the State may reasonably be urged to assist in promoting this much-desired tree propagation. By the offering of premiums for the best-planted homestead a spirit of competition would be fostered, and the societies could in this way render a valuable service to the farming community.

The comparatively recent institution of Arbor Day in connexion with our State schools gives promise of much good. Both officers and teachers of the Education Department are showing a laudable interest in making this day a means of amusement and instruction to the pupils. A special Arbor Day number of *The School Paper* has been issued for several years,

4. SUGAR GUM PLANTATION 2½ YEARS OLD.

and by developing a love for trees on the part of the children the interest and influence will no doubt lead to home planting. Many of the municipal councils actively assist in this movement, and if Mayors and Shire Presidents generally would make Arbor Day a special feature of their terms of office, the combined efforts would prove very effective.

Summarising the advantages that may be claimed for individual systematic tree culture, the following may be noted:—

- The improved condition of the homesteads, both as regards the personal comfort of the occupiers and the attractiveness of the home.
- The improved condition of stock resulting from the comfort of effective shelter from the extremes of heat and cold.
- The increased returns from stock.
- The protection of cultivated lands by break-winds.
- The protection of pasture lands from the drying effects of strong winds.
- The increased value of farm lands. A well-planted farm is certainly the more valuable.
- The ultimate assured fuel supply and timber supply for farm purposes.

In the selection of trees land-owners should to a great extent be guided by local conditions, and from our numerous varieties of eucalypts there need be no difficulty in choosing suitable trees. One variety, the sugar gum (*Eucalyptus corynocalyx*), is the most vigorous grower of our native trees, and may be planted in any district. (See illustrations Nos. 2, 4, 8, and 9.) It is described as a good timber tree, and has been known to attain a diameter of 16 inches in seventeen years. Other good varieties are—*Eucalyptus calophylla*, known as red gum tree of South-Western Australia; *E. cornuta*, of South-Western Australia; *E. botryoides*, bastard mahogany of East Gippsland; *E. tereticornis*, red gum tree of Eastern Australia; *E. rostrata*, red gum tree of Southern Australia.

In Mildura very effective screens have been formed by alternating sugar gums and pepper trees. (See illustration No. 9.) As a shade tree the well-known pepper, which flourishes in the hot northern districts, is of great value. The *Pinus insignis* and other pines are also very suitable for stock shelter, and in form and foliage are very fine trees.

5. A CHEERLESS, UNPROTECTED NORTHERN DISTRICT HOME.

Another means of home improvement which is to be commended is that of hedge-planting. Both for ornamental purposes and as wind-breaks this is most desirable, and, with reasonable care and periodical trimming, a well-grown hedge becomes a very attractive feature of a country home. The African boxthorn is probably the plant most generally grown, but the tree lucerne is now finding favour. This has the merit of being a quick grower, and can be readily grown from seed, flowers freely, looks well, and, being free from thorns, can be very easily trimmed. Messrs. Hawkins and Hart, the poultry experts of the Department of Agriculture, describe it as the best shelter that can be introduced into a poultry run. Several varieties of cupressus may also be planted, and, with care and attention, made to form very fine hedge shelter.

The lines with which this paper is prefaced, taken from *The Heart of Midlothian*, are very appropriate to the subject. They were the advice given by "Dumbiedikes" on his death bed to his son, and Sir Walter Scott had the assurance that their publication so influenced a Scottish earl

as to lead him to undertake extensive tree-planting. It is hoped that they will similarly impress some at least of the readers of this *Journal*. It should always be remembered that *time* is the great factor in tree production, and therefore time should not be lost.

By request, Mr. J. Johnstone, officer in charge of State Plantations, has kindly prepared the following notes *re* suitable trees and methods of planting. These notes, which are published in full, will afford an excellent guide to the grower.

TREES FOR SHELTER PLANTING, AND DIRECTIONS FOR PROPAGATING AND PLANTING.

Out of some hundreds of species now known to the arboriculturist, only a small number lend themselves to belt and screen planting on our treeless, wind-swept plains, exposed uplands, and coastal regions, where unchecked winds sweep inland, causing waste and destruction. As every hill, plain,

6. A GIPPSLAND HOME, WITH DEAD TIMBER, BUT NO ATTEMPT AT TREE PLANTING.

and coastal line has its own peculiar soil and climate, all of those must be considered, as well as the nature and habit of the trees to be planted. If this is not done, disappointment and death will be the result.

For shelter, evergreen trees are, of course, the best. They should be strong, hardy, vigorous growers, and provide for the farmer material for his work and fuel for his fire, and at the same time beautify the home surroundings.

The Eucalypts (Gum Trees).

This group is composed of evergreen trees, from which a few of the most suitable have been selected. Some of them, if planted singly, would make a noble shade in the open paddock for stock.

Sugar Gum (*Eucalyptus corynocalyx*).—This tree is well known for its general utility and early maturity. When properly pruned for shelter it is very effective. In growth it flourishes in a variety of soils and positions, but it is sensitive to frosts. Its dense dark green foliage and well-balanced, symmetrical habit, have made it a general favourite. Its timber is strong.

and, in addition to being excellent fuel, is suitable for many other useful purposes. As a timber tree it will grow to a height of 130 feet.

Red Gum (*E. rostrata*).—This valuable timber tree, with pendulous branches, affords a delightful shade. On river flats it grows largest. On the uplands their stems are much shorter, and their heads more spreading, and are perfect models of what a shade tree should be. More should be planted by the settlers, but not in belts. This tree can be raised open-root, and will transplant freely.

Yellow Box (*E. melliodora*).—This is a good shade-producing tree, and should be planted, but not extensively. On exposed areas in warm districts, where shade specimens are much in demand for stock, this tree should be planted.

Bastard Mahogany (*E. botryoides*).—It can be planted where the soil is saline. For belt planting it is not so good as the sugar gum.

Blue Gum (*E. globulus*).—Where the climate is cool, and the soil fairly

7. A COMFORTABLE FARM HOME WELL SCREENED BY YOUNG TREES.

good, the blue gum can be planted in blocks by themselves. As shelter belt trees they are an absolute failure.

HARDY CONIFEROUS TREES (PINES).

This genus is most important for general planting. *Pinus insignis*, the remarkable pine of California, is a handsome, hardy, fast-growing tree, and will do well in any kind of soil. As an all-round shelter tree we have nothing its equal. In the way of relief, *P. inops*, *P. densiflora*, *P. Halepensis*, the *P. laricio* family (noted for their timber and rapid growth), *P. contorta*, *P. resinosa* (the red pine), and *P. Canariensis* could be planted. The *Cupressus torulosa* and *C. Lambertiana horizontalis* are to be recommended. They make good trees and hedge screens, and do well in dry districts, and so will the *Schinus Molle* (pepper tree), and the last-named, if planted in line and cut back in spring, will form a graceful weeping wind-break round out-buildings and dwellings. The *Robinia Pseudacacia* (locust acacia) is a good yard shade. The carob tree (*Ceratonia Siliqua*) is a useful and profitable tree to plant, and so is the tree lucerne.

TREES SUITABLE FOR SALINE SOILS AND MARITIME SITUATIONS.

Eucalyptus gomphocephala, E. goniocalyx, E. botryoides, and in places *E. corynocalyx, Pinus Halepensis* (Aleppo pine), *P. Laricio* (Corsican pine), *P. pinaster* (maritima pine), *P. densiflora* (Akamatsu pine), and where suitable *P. insignis, Cupressus Nutkaensis, C. Lambertiana horizontalis* (from cuttings are best), *Ficus macrophylla* (Moreton Bay fig). On the coastal sands can be planted the *Myoporum, Acacia, Tamarix, Leptospermum* (ti-tree), and *Casuarina* families.

METHODS OF PROPAGATING.

The natural way is by seed. The *Tamarix, Myoporum*, and *Cupressus* can be raised from cuttings, and should be. Every settler on the land should have a small plot for the raising of his own trees. The site should

8. SUGAR GUMS ON EXPLOSIVES STORAGE RESERVE, NEAR SEA COAST, LAVERTON, ABOUT 5 YEARS OLD.

be fairly well sheltered, with a light sandy loam soil. The ground should be well dug, lined out in 4 or 5 feet beds, and then raked to a fine surface. The pine seeds should be soaked in cold water, and allowed to swell. The water should then be drained off, and the seed placed under cover for a few hours. Drill lightly the beds in three or four lines, and sow the seed straight away in the drilled lines, and cover up with the back of a light rake. If the soil is dry, water well with watering can and fine rose, and keep the ground moderately moist. In ten or eleven months' time the seedling plants should be lifted, and transplanted in nursery lines, 3 to 4 inches apart and from 14 to 18 inches between the rows. In this position they can remain for one or two years. They will then be large enough to remove to their permanent quarters. The sowing should be done during August and September, but this depends on the season and district, the northern areas being first planted. In 1 lb. weight of pine seed there are from 19,000 to 90,000 seeds, the price of which can be obtained from any seed merchant.

The Raising of Gums.—The seed can be sown from September to November, in boxes, pots, pans, or open beds. If in open beds, in the absence of a cement bottom something in the shape of hardwood boards or sheet iron should be laid 7 or 8 inches below the surface to prevent the roots of the seedling gums from going down. The seed beds should be from 3 to 4 feet wide, with a fine smooth surface. Water the bed before sowing. Sow broadcast, after sifting with a fine sieve, in loamy soil, light and dry, with a little decayed leaf mould mixed; spread it lightly and evenly over the seed; water with a fine rose. A temporary screen over the gum beds would assist the seed and protect the plants. If boxes are

9. MILDURA STREET PLANTING. SUGAR GUMS AND PEPPER TREES ABOUT 12 YEARS OLD.

used they should be from 4½ to 5½ inches deep, with holes for drainage in the bottom. When filling the boxes, place over the holes (for open drainage purposes) curved pieces of crocks or charcoal. Fill in with moderately-sifted loamy soil to within 1½ inches of the top; water, sow, and cover the seed as directed for the open beds. As plants in boxes are liable to be drawn, great care must be taken to keep them exposed to the light, and only shade when required. This method of raising gums will suit the farmer, but not the forester, nor the man who wishes to send the plants a distance. The seed will cost from 1s. 6d. to 2s. 6d. per ounce.

Planting.—The pines, cupressus, &c., should be planted out in June or July, and not later than August. In warm districts, where frosts are not

severe, gums (if properly hardened off) can also be planted. They will then be well established before the hot weather sets in. In cool districts, where frosts are severe, gums should not be set out until all danger is past. In lifting the gums for transplanting, great care must be taken not to injure or expose the roots. Allow as much earth as possible to remain on the roots; on gums every root is required. If reduced when transplanted into a new soil and position, the remaining roots will be unable to supply the stem and foliage with sufficient moisture. Hence so many deaths, through the moisture passing away from the stem growth faster than the roots can supply the sap waste. Gums should be planted out in their permanent place when young and small, say from 4 to 12 months old.

Preparing the Ground and Planting.—Take out square holes 12 x 12 or 24 x 24 inches wide, and the same in depth; place the surface soil on one side of the hole, and the sub-soil on the other. For shelter planting on exposed sites the holes should be 8 feet apart, and thin out as the trees grow. When the soil is pulverized, and not too wet or too dry, and the holes free of water, fill in by placing the soil as it was taken out. Should the sub-soil be poor, mix a little surface soil with it. For planting select dull weather. Dry winds are injurious to plants out of the ground; avoid removing them. For planting it is better that two persons should be employed at the work. When root space is made in the centre of the filled-in hole by one man, the other can place the tree in its position from beneath a cover, and steady it while the fine earth is being filled in and pressed gently round.

Sowing Suitable Gums in Belts.—Where this can be done it is the cheapest and best. In rangy country, where there are steep slopes thickly dotted with tree stumps and outcrops of rock, and the surface a tangle of roots, nursery growth must be planted. Where the soil is free from obstacles of this kind, seed planting can be proceeded with. The nature of the surface and sub-soil should be understood, as on this will depend the depth of the ploughing. A good shallow surface must not be buried or mixed out of proportion with a stiff clay sub-soil, that will run together in wet weather, and bake into a hard crust in summer. If the sub-soil is free, open, and porous, plough deep, and work it up to a fine tilth.

Mix the gum seed with dry sandy loam, well sifted, and sow by hand broadcast out of a dish, seed bag, or box. Then pass a light harrow over it. This done, the success of the crop will depend on the season. For this work May, August, and September months are the best. On the climate and district will depend the month selected for the work. As the trees advance in growth thin out, and allow them growing space. A mixed sowing should not be done unless the cultivator understands the nature and habit of the trees he is about to mix. Fence off with a temporary dropper fence. The seed, cultivation, and fence will cost from £2 5s. to £3 5s. per acre, that is, when the planting is done along a permanent boundary fence.

Note.—The foregoing article has dealt chiefly with plantations of native trees. In districts where there is no great danger of bush fires the claims of the oak, the elm, and other European trees should be considered. Besides the value of the timber they are of special value on account of the fodder furnished by the leaves and fruit. This matter will shortly be dealt with in the *Journal*. The illustration on the front cover of this issue is that of a 40 year old elm tree at Gisborne.—Editor.

THE MAGPIE LARK.

Grallina picata (*Latham.*)

C. French, F.L.S., F.E.S., Government Entomologist.

This bird, commonly known also as Pe-wit, Mud-lark, Pied Grallina, &c., is a general favourite with bushmen and residents in the city and suburbs. Probably this is one of our commonest and most widely-known birds, being a great destroyer of insect life, all and sundry. Its well-known note "Pee-wee," is always heard in the vicinity of rivers, water-holes, or swamps, where, amongst the trees overhanging the water, it constructs its well-known mud nest and rears its young. It also builds in pine and other trees in the Melbourne Botanic Gardens and reserves, and, as the nest is usually placed at the end of a branch, it is, fortunately, in most instances, out of the reach of boys. The nest is constructed of small pieces of mud, clay, mixed with pieces of dried grass, &c., and measures usually about five to six inches in breadth, and from three to four inches in depth. The eggs, usually four constitute a full set, vary greatly. The usual variety is of a pinkish white ground colour, with brownish spots, often forming a distinct zone at the larger end. In some instances the ground colour is light reddish, with a zone of dark, reddish spots also forming a zone on the larger end. On the Murray, at Benjeroop, near Kerang, I have seen old nests of the Magpie Lark used by the white-rumped wood swallow (*Artamus leucopygialis*), and, according to Mr. A. J. Campbell, the little Cuckoo Shrike (*Graucalus mentalis*) constructs its nest also within that of the Magpie Lark.

The following is Gould's description of the Magpie Lark:—"The sexes are very similar in size, but the female may at all times be distinguished from the male by her white forehead and throat, a fact I determined many times by actual dissection, thus showing the fallacy of the opinion entertained by some naturalists of there being two distinct species.

The male has a line over the eye, a patch on each side of the neck, a longitudinal stripe on the wings, tip of the secondaries, rump, upper tail-coverts, the basal two-thirds and the tips of the tail, undersurface of the shoulder, breast, flanks, abdomen, and under tail-coverts white; the remainder of the plumage black, with a deep bluish tinge on the head, throat, chest, and back, and a green tinge on the primaries and tail; bill yellowish white; irides, straw-yellow; feet, black.

The female differs in having the forehead, lores, and chin white. The young on leaving the nest have the irides black; in other respects, they resemble their parents, but are, of course, far less brilliant in colour."

Mr. A. J. North records the following interesting particulars regarding this useful insectivorous bird:—"Stomachs of these birds, which I have examined, contained chiefly portions of various insects, those being shot near the coast also containing a little sand mixed with a few blades of grass. I have never known it to eat fruit or grain. Pastoralists, sugar-planters, farmers, and orchardists, to whom this bird renders valuable services, should, therefore, assist in affording it absolute protection by preventing thoughtless boys and pot-hunters from trespassing on their lands in search of 'something to kill,' not only in the close season, but all the year round. The ever-trustful and fearless disposition of the bird should in itself be a sufficient claim to the protection it undoubtedly deserves; but,

C.C.Brittlebank, del. C.French, direxᵗ R.S.Brain, Govᵗ Printer

unfortunately, the easy manner in which it may be approached is too often the cause of many of them falling victims to misplaced confidence in man. It is an extremely sociable species, frequenting the vicinity of houses, and breeding in trees close to the streets in many of the outlying suburbs."

With regard to the courage displayed by this bird, it may be mentioned that, as a rule, very few other birds care to attack it, and even the pugnacious Magpie (Crow Shrike) does not care to interfere with it, the reverse being often the case, as it is quite a common occurrence to see these little birds chasing after a magpie.

The Mud-lark is widely distributed throughout Victoria, and is found also in South Austalia, Queensland, New South Wales, South and Central Australia, Western and North-western Australia, and Tasmania.

THE ELEMENTS OF ANIMAL PHYSIOLOGY.

W. A. Osborne, M.B., D.Sc., Professor of Physiology and Histology, Dean of the Faculty of Agriculture in the University of Melbourne.

(Continued from page 600.)

CHAPTER III.

Hormone and Nerve.

Cells that are specialized to carry out a particular function are as a rule not scattered singly over the body, but grouped into masses; thus the cells that secrete tears are found clustered together into the two organs called lachrymal or tear glands. In such a structure the active cells are held in position by connective tissue, and have arrangements whereby nutriment is brought to them, waste matter removed, and a special outlet or duct system given to their secretion, if they have such. It will be at once obvious that if such cells were to act irregularly and spontaneously, and without any regard to what is going on in the other parts of the body, the latter as a whole would be incapable of carrying out any individual function. We find, on the contrary, that the active cells of the body are under a stern discipline; with specialization of function they have forfeited the power of spontaneous action; they must work at the right times and with the proper intensities; they must start, quicken, slow down, or stop when ordered to do so, and only when so ordered. To understand how this can occur we must first of all assume that in each active cell there is not only the special machinery for carrying out the cell's particular function, but also a substance or mechanism called the RECEPTIVE SUBSTANCE, which can receive a message, and be set into action by the message, and by its action influence the machinery of the cell, either increasing (also starting) or diminishing (also stopping) its action. This receptive substance, although not a part of the special machinery, is still a portion of the cell, and dies when the cell dies. In each cell of voluntary muscle (striped or skeletal muscle) there is only one receptive substance, which in this case can start or augment

the activities of the contractile elements of the muscle cell. When such a muscle cell stops contracting, it does so because its receptive substance is no longer receiving any message. The drug curare (South American arrow poison) has this interesting property, that it temporarily destroys the receptive substances of voluntary muscle all over the body, so that, although urgent messages may be sent, the muscles remain uncontracted and useless. That the contractile part of the muscle is not affected can be shown by stimulating the curarized muscle with electricity, when a vigorous contraction can be evoked. Hence it is that in an animal poisoned by this drug all movements, including breathing, cease, and death occurs through asphyxia, though the muscles themselves remain as powerful as ever.

In the cells of involuntary (smooth) muscle and heart muscle, and in the cells of most secreting glands, we find two receptive substances, one which can start or quicken, and the other which can slow down or stop. It must be clearly understood that each receptive substance is fitted for a

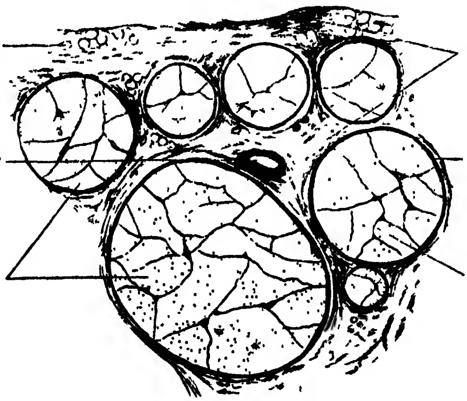


Fig. 29.—Portion of a cross-section of a nerve-trunk magnified twenty times. (After Stöhr.)

particular mechanism; no matter how the receptive substance is set into action, it always acts in the same way on the cell mechanism, either to depress or to augment its activity.

So far as physiologists have been able to discover, there are but two methods by which a receptive substance may be set into action. The first is through the agency of a chemical substance, or HORMONE, which travels in the blood stream, and so reaches eventually the cells to which it is destined; the second method is that of the nervous system.

The Hormone.

No more instructive instance of hormone action can be given than that which is responsible for the activities of the pancreas, a gland which pours its digestive secretion into the first part of the intestine, not far from its commencement at the stomach. Now, the contents of the stomach (fourth stomach of ruminants) are acid in reaction, and when this acid mixture leaves the stomach and enters the small intestine, the acid present acts chemically on the wall of the gut and produces a hormone, called Secretin. This secretin, as soon as it is formed, is caught up by the blood vessels, and is swept along in the blood stream, and so reaches all

parts of the body, including the pancreas. When the secretin has reached this organ, at once the receptive substances are stimulated, and the gland begins to pour out its special secretion—pancreatic juice—into the gut, and right into the middle of the acid stuff from the stomach. Now, the pancreatic juice is alkaline, for it contains carbonate and bicarbonate of soda, and thus when enough has been poured into the gut it will annul altogether the acidity of the stuff from the stomach. But it was this acid which formed the hormone SECRETIN, and started it on its travels, so that when there is no longer any acid there will no longer be any secretin, and the pancreas will therefore no longer be stimulated. But soon the stomach will send a fresh squirt of its acid contents into the gut, secretin will be formed by the acid, the pancreas will be stimulated, and the pancreatic juice will keep pouring into the gut as long as there is any acid left unneutralized. By this automatic mechanism the pancreas will start acting at the right moment, namely, when food enters the intestine from the stomach; and with the proper intensity, which will depend on the strength of the

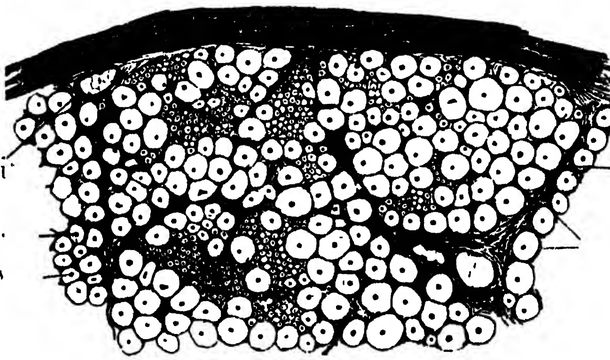


Fig. 30.—Portion of a cross section of a nerve trunk magnified two hundred times (After Stohr.)

acid; and for a sufficient interval of time, namely, until the acid has been neutralized, for until this has been effected the digestive ferments in pancreatic juice cannot come into play.

We know of many other hormones which are at work in different parts of the body. The profound changes that occur in both sexes as a consequence of puberty, and the alterations in the mammary gland (udder) during pregnancy, are instances of hormone action.

Of the chemical constitution of the hormones but little is as yet known, only one true hormone, namely, ADRENALIN, a substance produced in small organs situated near the kidneys, and hence called adrenal, or suprarenal, glands, having been identified by the chemist and prepared in the laboratory. But secretin and the hormones produced in the reproductive organs and in the thyroid gland in the neck, &c., have so far baffled the chemist's researches, chiefly because they are present in the body in such extremely small quantities that to prepare an amount sufficient for an exhaustive analysis is at present impossible. We know this, however, about hormones that they are all comparatively simple bodies; some of them are probably closely allied to certain vegetable alkaloids, and to this similarity in structure we may ascribe the medicinal properties of the alkaloids. For instance, the drug pilocarpine, when it gains admittance to the blood

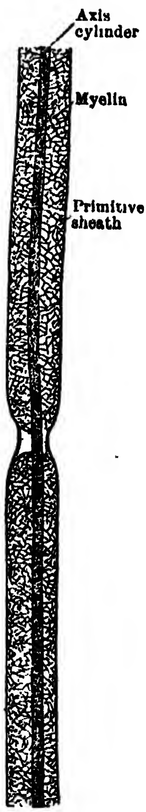


Fig. 31.—Nerve fibre showing axis cylinder and insulating material (medulla or myelin). (After Kölliker.)

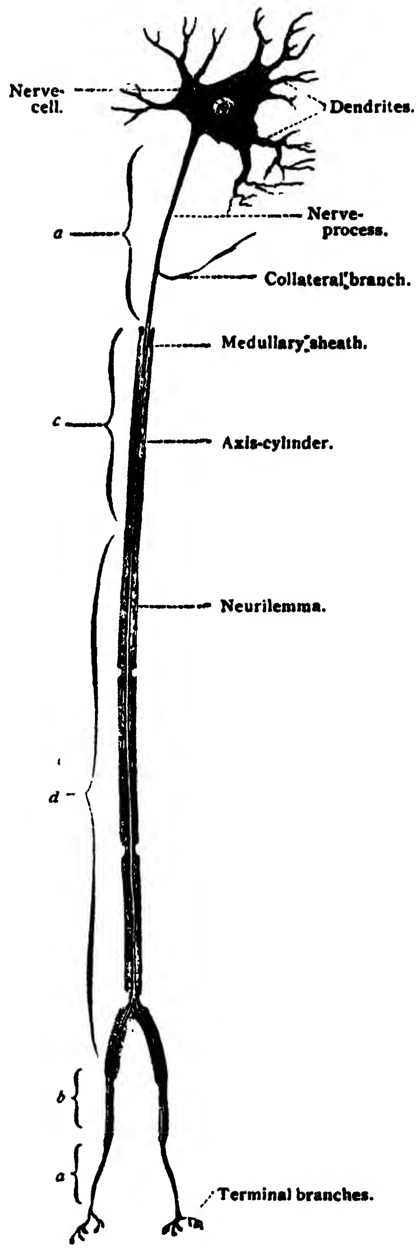


Fig. 32.—Diagram of a neuron. (After Stöhr.)

stream, stimulates through their receptive substances nearly all the secreting glands of the body. The drug atropine paralyzes these same receptive substances, as well as some others. As a rule, the vegetable alkaloids do not act so specifically as the hormones; they act rather on groups of organs than on any one singly, a fact which is probably to be explained by their

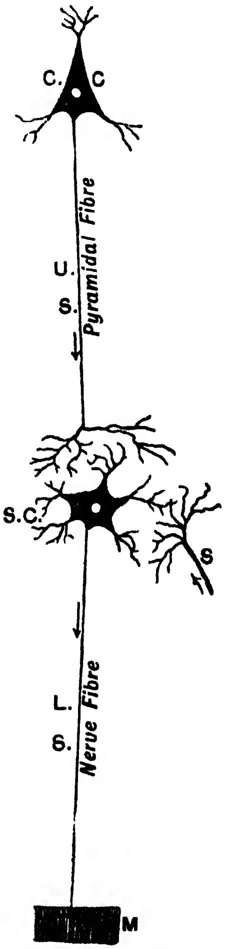


Fig. 33—Diagram showing two neurons S. and U.S. uniting with a third L.S. (After Gowers.)

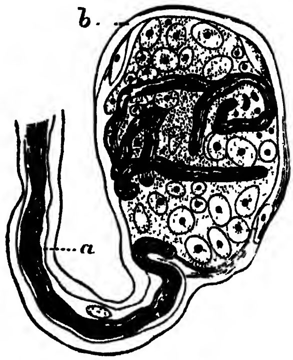


Fig. 34.—Sensory nerve ending in skin.

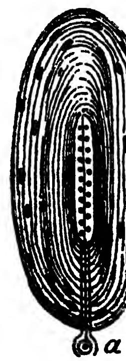


Fig. 35.—Sensory nerve ending in tongue of duck. (After Klein.)

chemical structure. They may be likened to master keys which can open a number of locks; whereas a hormone may be fitted for one lock only.

The automatic mechanisms which employ hormones, though they may be sure, must certainly be slow. The hormone is formed, then caught up by the blood, and then distributed by means of the blood stream to all parts of the body, including the organ which it is fitted to stimulate. This procedure at its quickest is still slow, compared with some of the reactions

of the body. The burnt child that touches the fire withdraws its hand in a fraction of a second; were the hand to remain until the heat formed a hormone which, when it reached the muscles of the arm, excited them to draw the hand away, there might be very little hand to take care of. Plainly, there is another system of messages in the body, a system which may be likened to the telegraphic, whilst the hormone may be compared with the letter post. It has been named already—the nervous system.

THE NERVOUS SYSTEM.

When we cut across what is popularly termed a nerve, but what the physiologist prefers to call a nerve trunk, and examine it under the microscope, we get appearances such as are given in Figs. 29 and 30. The nerve trunk is in reality composed of several thousand nerve fibres, grouped together into bundles. If we examine one of these fibres we shall find in its centre a core, which is concerned with the conduction of the nerve message, and to which the name AXIS CYLINDER, or AXON, is given. Around it we find an insulating jacket, composed of a phosphorized fat, the MEDULLA, or MYELIN, which is, however, not complete, but broken at intervals, as shown in Fig. 31, so that nutriment can get into the axis cylinder.

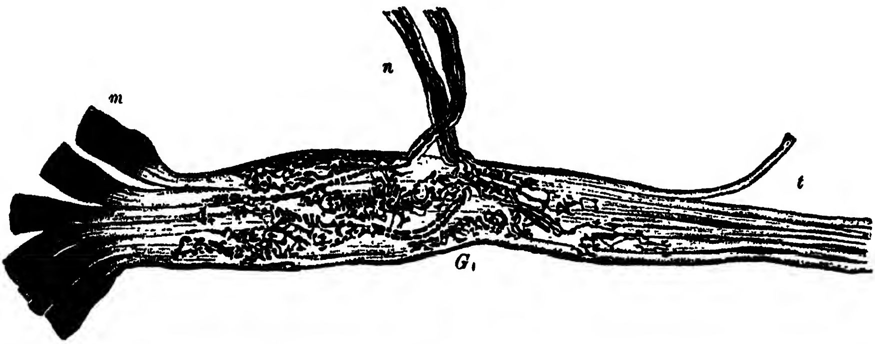


Fig. 36.—Sensory nerve ending in tendon. (After Ciaccio.)

If we choose any nerve fibre anywhere in the body, and follow it along its course, we shall always come in one direction or the other to a nerve cell. In fact, a nerve fibre, or, more correctly stated, the acting part of a nerve fibre, the axis cylinder or axon, is a prolongation from a nerve cell, and is therefore part of that cell. Nerve cells may possess few or many prolongations, but generally one can be picked out which is a typical axon or axis cylinder. Most axons acquire the insulating jacket, or medulla described, and are therefore termed medullated nerve fibres; some, however, do not, and are termed non-medullated nerve fibres. Every nerve fibre contains an axon, and every axon is a process from a nerve cell. To this whole system—the nerve cell, with all its prolongations, axon included—the name NEURON has been given. It is important to have a clear idea as to the neuron, for out of neurons the entire nervous system is built. The nerve trunk cut across, and shown in Fig. 29, contains several thousand axons, each of which is part of a nerve cell. Where the nerve cell is situated will depend on the specific use to which its axon is put.

Now, the function of a nerve fibre, or axon, is to transmit a message, called a NERVE IMPULSE. What the impulse exactly is still baffles

all attempts of physiologists to discover. We know that it is not something material which is driven or sucked along; nor is it a chemical change which runs along the axon as fire will run along a train of gunpowder; nor is it an electric current such as runs in telegraph and telephone wires, for its speed is too slow for this—the electric current travels at the rate of some hundred thousand miles per second, whereas the nerve impulse, if given an axon long enough, could never cover more than 65 yards in the same time. All that we can state is that the nerve impulse is a physical change, which runs along the axon without leaving it permanently altered by being so used. A wave travelling along water, a sound travelling through air, a twist running through a long thin strand of jelly, are instances of physical changes, but they are not quite the same as a nerve impulse. That the nerve impulse is not chemical is shown by the absence of any rise in temperature, and by the fact that no waste products can be detected. Moreover, the axon cannot be fatigued; a hundred thousand impulses may pass through an axon in quick succession, and the last be transmitted as quickly and powerfully as the first. The only detectable change in the nerve fibre which accompanies the passage of an impulse is a change in the electrical state of the nerve as tested by delicate instruments. Most probably the impulse is a change in the arrangement of the particles inside the axon, which we know are charged with electricity; when the impulse has passed these swing back into their old positions.

An impulse is very readily started in a nerve fibre; most things which destroy its delicate structure will bring an impulse into being—for instance, crushing, burning, or irritation with corrosive chemical bodies. These may be applied, however, so weak as not to injure the substance, but still capable of starting impulses; thus, tapping a nerve lightly will send impulses along it; electric shocks are very efficient starters also. Now, in all these cases, whenever an impulse is started artificially somewhere in the course of an axon, the impulse travels always up and down, and passes into every branch of the nerve cell. We may here lay down the law that if an impulse be started in any part of a neuron it will travel through every part of that neuron. Now, in nature it never happens (except in accidents) that a nerve impulse starts in the middle of an axon; provision is always made that it shall travel from one end of a neuron to the other end.

Another fact about nerve fibres follows at once from what has been stated in a former chapter. If a nerve fibre be cut, then that portion still in contact with the nerve cell lives, the portion cut off from the nerve cell dies. This fact gives the experimenter a valuable method for tracing the destination of any particular group of fibres.

The nervous system is divided into two parts—the CENTRAL NERVOUS SYSTEM, composed of brain and spinal cord; and, secondly, the parts that lie outside the central nervous system, and to which the name PERIPHERAL NERVOUS SYSTEM has been given. In the peripheral nervous system we meet with four types of neurons—one type which carries impulses *into* the central nervous system (or C.N.S., as we may briefly call it), the other three types being concerned with the passages of impulses *out* of the C.N.S. We shall deal with these in sequence.

ENTRANT or AFFERENT Neurons—that is, neurons which carry impulses into the C.N.S.—are all of the type indicated by A in Fig. 39. The nerve cell is small, and is to be found in a ganglion placed near the C.N.S., but not in it. We find such ganglia near the spinal cord, and called dorsal root ganglia, to be described in a later chapter. The connexion of

the axon with its cell by a T-piece is fairly characteristic of this type. If we trace such an axon towards the periphery—that is, away from the C.N.S.—we shall find that it comes to an end in a special organ specially made for the starting of impulses. Let it be at once understood that all these afferent or sensory nerves are the same in nature. They differ, however, in their connexions with the C.N.S., and in the nature of the end-organ or sensory end-organ, which starts impulses in them. The impulses themselves do not differ one from another; what gives them their special significance is their place of origin and their destination in the spinal cord and brain. Each nerve is a mere conductor of nerve impulses, and impulses only differ from each other in intensity.

A sensory end-organ we may look upon as a special apparatus, which will start an impulse in the nerve to which it is attached when it is disturbed

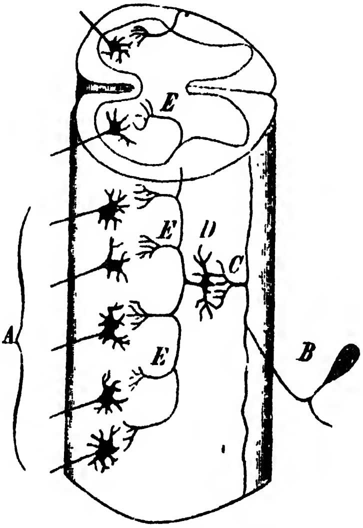


Fig. 37.—Diagram showing how an impulse entering the central nervous system by a sensory neuron DE may pass to the motor neurons A by means of the linking neuron DE. (After Kolliker and v. Lenhossek.)

in a particular manner; we generally find, too, that the end organ is shielded from disturbances which it is not asked to record. Thus we find in the skin of all the higher animals certain end-organs which start impulses when they are warmed. The animal will thus feel the sensation of warmth, and will ascribe it to the part of the skin warmed; but if the nerves coming from these same end-organs were stimulated with electricity, and not heat, the animal would still have the sensation of warmth, and would locate the feeling at the spot stimulated. It is the point of origin and the distribution in the C.N.S., and not the nature of the impulse which determines the nature of the sensation.

A tabulated list of the sensory end-organs may be given as follows:—

(*a*) Confined to the skin, starting impulses—

1. On application of pressure; or at the base of a hair when the hair is moved, giving rise to touch.
2. When warmed, giving rise to sensation of warmth.
3. When cooled, giving rise to sensation of cold.

(*b*) In muscles and tendons (sinews) and ligaments of joints, starting impulses when these are stretched, and therefore informing the C.N.S. as to their condition.
(*c*) In the eye, shielded from heat, and to some extent from mechanical injury, and starting impulses when acted upon by light (or darkness after light).
(*d*) In the ear, starting impulses when acted upon by waves of sound.
(*e*) In the semi-circular canals of the ear (the most important sense organs animals possess). Here impulses are produced by the way in which water lies (or is driven by movements of the head), in a system of arched tubes that run in three directions, and in this way tell the animal the position of its head, and in what direction its head is being moved, and thus allow the body to be kept balanced.
(*f*) In the nose, starting impulses when acted upon by certain gases, giving sense of smell.
(*g*) In the mouth, starting impulses when acted upon by certain soluble chemical bodies, giving sense of taste.
(*h*) Widely distributed over the body, and starting impulses when anything threatens to destroy the structure of adjacent living tissue; hence acting as danger signals, and giving the animal sensation of pain.
(*i*) There are other nerve endings in the body which can start impulses under special conditions - for instance, those telling the animal that its stomach is empty, or its bladder full, &c., &c. These, however, are few in number, and highly localized.

In these end-organs impulses can be started, and in most of them impulses are constantly being started, which, travelling along their respective axons, enter the central nervous system. The course of these impulses through the C.N.S. this is hardly the proper place to describe. It will be sufficient to say, that each afferent neuron makes connexion in the C.N.S. with a number of other neurons, and each of these latter with a number of others, so that the impulse after it arrives is carried up and down, and is widely distributed through the C.N.S. The passage of an impulse from one neuron to another takes place at a region called a SYNAPSE, where branches from both neurons interlace. Of the importance of the synapse something will be said later, but one of its peculiarities must be mentioned here, and that is its valve action, which allows impulses to pass in one direction only. Hence it is that no impulses ever leave the C.N.S. by any of the afferent nerves, and, conversely, none can get in by any other channel. The nerve impulses that enter the C.N.S. pass through it in various directions, such directions being determined by the past history of the race (reflex action and instinct), and the past history of the individual (memory and intelligence). They do not lose in intensity by being thus scattered; in fact, they may gain enormously in power, and may last for much greater intervals of time, a change which is effected by the nerve cells of the neurons through which they pass. The nerve cell of the afferent neuron does not influence the impulse; it has, in fact, but few duties to perform, chief among which is maintaining the integrity of the whole neuron; but the cells of the C.N.S. not only preserve the vitality of their axons and other prolongations, but also do actual work by augmenting and prolonging the impulses which pass through them. We must picture the C.N.S. as constantly receiving impulses from its afferent neurons. These impulses

pass through and through the dense network of neurons of which the C.N.S. is composed, blend with each other into special combinations, and finally leave the C.N.S. by exit or efferent paths, of which there are two types—

1. Motor to Voluntary Muscle (Fig. 39B).—The nerve cell is found in the C.N.S., and from it an axon passes uninterruptedly to a muscle; the axon divides up in the muscle substance, and each branch ends by passing into the receptive substance of a muscle fibre.
2. Autonomic Paths. — Each autonomic path is peculiar in that the efferent nerve fibre does not pass uninterruptedly to the organ to be innervated, but ends by branching round a nerve cell which is situated in a nerve ganglion (Fig. 39C). To this nerve fibre the name PRE-GANGLIONIC is given. (In the diagram, for the sake of clearness, the pre-ganglionic fibre is made to branch round one cell only; in reality it branches round several, and so the impulses multiply.) From the nerve cell in the ganglion a nerve fibre (axon) called POST-GANGLIONIC passes into the receptive substance of the cell innervated (Fig. 39D).

It is interesting to note that, whilst the first type of efferent nerves, viz., the motor, passes only to one kind of tissue, namely, voluntary muscle, in the autonomic system, we find that the post-ganglionic fibres can pass to two different types of tissue—

(*a*) involuntary (smooth) muscle found in the walls of the stomach, bladder, gut, uterus, and the various ducts of the body; also the muscles in the walls of arteries and veins and the small muscles attached to roots of hairs (and feathers). Heart muscle must also be included here.

(*b*) Secreting glands, such as the glands of the stomach and intestine, the salivary glands, tear glands, sweat glands, &c.

One very important character about these organs innervated by the autonomic system is that they are not under the influence of the will. An animal can move its voluntary muscles at will, but over heart and artery, stomach, bowel, gland, &c., the will has no power; these organs, innervated by the autonomic system, receive their nerve impulses, therefore, in a purely ***automatic*** manner, and the number, duration, and intensity of the impulses they receive from the C.N.S. will depend on the nature of the impulses that have gone ***into*** the C.N.S.

Another striking character of the autonomic system is that whilst it may be divided anatomically into three parts—namely, that coming from the brain (cranial autonomic), that from the spinal cord in the thorax (thoracic autonomic), and that from the lowest portion of the spinal cord (sacral autonomic)—it may physiologically be divided into two parts only, namely, the thoracic autonomic on the one hand, and the cranial and sacral on the other. The thoracic autonomic system has long been known under the name of the ***sympathetic system***, from a mistaken idea as to its nature.

We frequently find that an organ is supplied with two sets of autonomic nerves with different functions, one of these sets always being thoracic autonomic, or sympathetic, the other being either cranial or sacral. For instance, the movements of the stomach (stomachs of ruminants) and small intestine are depressed by thoracic autonomics, but excited by cranial autonomic (vagus nerve). The movements of the large intestine are depressed

by thoracic autonomic impulses, but excited by sacral. The heart is slowed down in speed by cranial antonomics (vagus fibres), but excited by thoracic. The salivary glands secrete a copious watery saliva when the cranial autonomics are stimulated, but a scanty and thick saliva when the thoracics are stimulated. The iris dilates under the influence of thoracic, but constricts under the influence of cranial. The arteries in the reproductive organs are dilated by sacral, the arteries of the salivary glands are dilated by cranial, but all arteries of the body except those in lung and brain, which have no nerve supply, are constricted by thoracic autonomic impulses.

Mention may be made here of the fact that the nerve trunks which we find in the animal body generally contain representatives of more than one of the four types of neurons described. Thus, the sciatic nerve contains afferent, motor, and post-ganglionic axons; the vagus nerve contains afferent, motor, and pre-ganglionic axons; nerves connected with muscles always contain afferent as well as motor fibres.

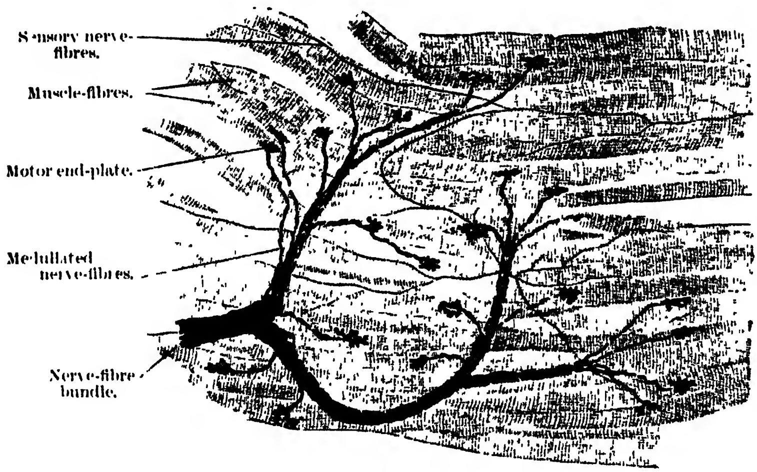


Fig. 38.—Motor nerve-endings in muscle. A few sensory nerves coming from the muscle are also seen (After Stöhr.)

Reviewing the whole nervous system, we find, first of all, that there are organs in which impulses can be started, namely, sensory end-organs. The impulses thus started travel by means of afferent nerves to the central nervous system. After traversing the C.N.S., and being modified as regards power and duration, they pass out into two sets of efferent paths, one going to voluntary muscle, the other set going to organs over which the will has no control. The central nervous system, though it can modify impulses, apparently cannot create them. If no impulses pass in none will pass out. Even if a limited number of entrant or afferent paths be blocked, some of the exit or efferent cannot be used. If, for instance, the sensory nerves of a limb be cut, the limb cannot be moved by any effort of will—it is as completely paralyzed as if the motor nerves were cut. The same may be seen on a reduced scale when one's fingers are very cold, and in consequence clumsiness of their action ensues. The cold paralyzes the sensory end organs of the skin, tendons, and joints of the fingers, but does not affect the muscles of the forearm which move the fingers, and yet these muscles are partially paralyzed.

This conception of the dependence of outlet impulses on inlet should always be borne in mind. If, for instance, we find that an organ is receiving an unusual rush of efferent impulses, there is generally some alteration in the sensory impulses to account for it. The muscles of the dog's hind leg that are thrown into action when the animal scratches, receive their impulses from the spinal cord, but the original impulse was started at the skin by something tickling the skin. It is interesting to note that the action of scratching, like many other actions, needs only a portion of the C.N.S. to carry it out. A dog which has its spinal cord cut across in the neck will scratch with its hind foot when a spot on the back is tickled, though it feels nothing with its brain, and is apparently unaware of the whole proceeding. The leg of a man whose back is broken across will kick out when the sole of the foot is tickled, and yet the man be utterly unconscious of the action, and unable to move his legs by any effort of will.

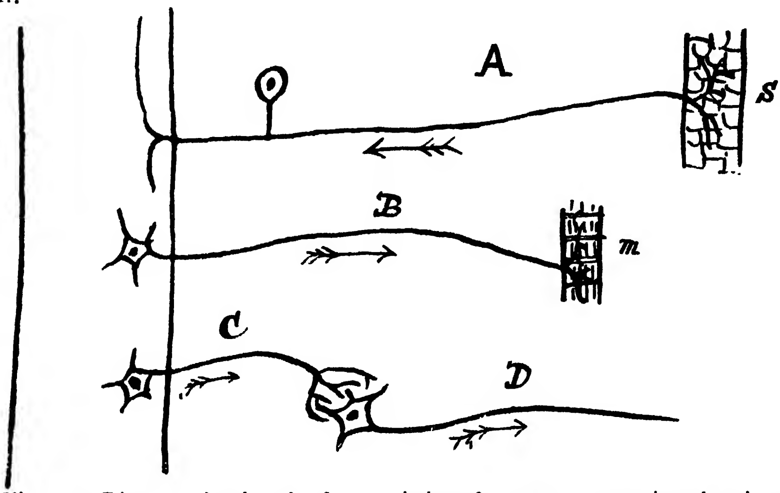


Fig. 39.—Diagram showing the four varieties of nerves carrying impulses into or from the central nervous system. (*a*) Afferent fibre from the sensory surface, *s*, to the central nervous system. The cell is situated in a ganglion close to but not within the central nervous system. (*b*) Motor fibre to the voluntary muscle, *m*. The cell is situated within the central nervous system. (*c*) Preganglionic fibre from cell in the central nervous system to ganglion. (*d*) Post ganglionic fibre from cell in ganglion to involuntary muscle or gland.

There is, however, another method by which the exit or efferent impulses may be modified, and that is by chemical bodies, which influence the nerve cells inside the C.N.S. For instance, in ordinary vomiting the afferent impulses start usually from the wall of the irritated stomach, or from the back of the mouth, pass into the C.N.S., and then out into the muscles concerned in the act of vomiting. In those animals that vomit readily this act can be produced by injecting the drug apomorphine, which operates on the nerve cells concerned with the motor impulses of vomiting, and if it does not start impulses in them, at any rate makes the cells irritable, and responsive to afferent impulses which normally would be far too weak to have any effect. These nerve cells particularly concerned with vomiting constitute what is termed the NERVE CENTRE for vomiting. There are similar centres for breathing, swallowing, &c., which will be dealt with later.

We can now understand why the child draws its burnt hand away from the fire. Impulses have started in the burnt finger, which will be classified by the child as pain, they reach the central nervous system, pass through it, and pass out into the motor nerves which run to the muscles of the affected limb, causing them to contract, and the hand, therefore, to be quickly withdrawn. If it be asked why do the impulses go to the right muscles, and not to the other parts of the body, we may answer that the child was born with certain paths laid down in its central nervous system, along which impulses will pass in preference to all others, and that this is one of them.

ARSENITE OF LEAD SPRAY FOR CODLIN MOTH.

E. E. Pescott, Inspector, Vegetation Diseases Acts, Bendigo.

Owing to the prevalence of codlin moth, it is now a recognised fact among orchardists that the only adequate method of coping with this pest is to spray the trees and fruit with some arsenical solution, whereby the young grub may be poisoned before entering the fruit. Paris green was amongst the first sprays used for this purpose. This was afterwards superseded by arsenite of lime. Latterly, however, in the Bendigo district, as well as in other places, the arsenite of lead spray has become very popular, and has been used with excellent results. The majority of growers using this spray now consider it superior in every way to arsenite of lime or to Paris green. The formula is as follows:—1 lb. white arsenic, 2 lbs. carbonate of soda crystals, 7 lbs. acetate of lead, and 360 gallons of water.

To make the stock solution, the arsenic and soda should be boiled together for from 20 to 30 minutes, in half a gallon of water. The acetate of lead should be separately dissolved in one gallon of warm water. When cold, the arsenic-soda solution should be gradually stirred into the lead acetate solution till both are thoroughly mixed. If mixed when warm the union of these two solutions results in extreme effervescence, and great care should be taken that the froth does not run over the vessels used. When cooled, the mixture becomes liquid again, and may be stored away for use. There will be twelve pints of the stock solution, and if this be placed in twelve pint bottles, one bottle can be used to every 30 gallons of water. The stock solution will keep indefinitely.

This spraying solution is considered superior to arsenite of lime for many reasons. Provided the water be strained, the mixture runs freely through the pump, and the whole of the contents of the cask may be sprayed without once choking or clogging the nozzle. This point alone should make the spray a popular one. In the arsenite of lime spray trouble is often experienced in obtaining freshly-burnt lime, and the resultant mixture is not as perfect nor as effective as it might be. The absence of good lime, too, might have a caustic effect on the foliage. This spray adheres better to the foliage and fruit than other sprays, and consequently less material may be used for each tree. Again, the trees are not rendered unsightly, as with the lime spray, and the fruit does not require cleaning after picking. In spraying with arsenite of lead, the spray should be misted finely on to the trees; the liquid should not run down the limbs and trunk. It is a mistaken idea that the running spray will kill any grubs that may be hiding in the crevices of the tree. The

arsenite of lead spray does not kill by contact; its effect is to poison the grub that eats it. This spray also keeps down the pear-slug pest.

In the season of 1904-5 Inspectors Cock and Pilloud conducted a small experiment at Dunolly with the three arsenical sprays, viz., Paris green, arsenite of lime, and arsenite of lead. Three rows of trees were selected, and a row of twelve trees was sprayed with each spray. The result, which was as follows, speaks for itself:—Paris green, 75 per cent; arsenite of lime, 82 per cent.; arsenite of lead, 90 per cent. of perfectly clean fruit.

Some growers, in districts where Black Spot is prevalent, add 1 lb. of bluestone to every 50 gallons of this spray. Messrs J. Clarkson, of Lockwood, and J. Hargreaves, of Emu Creek, used this combination last season with excellent results. The latter grower estimates that, by the use of the arsenite of lead spray, he last season obtained 98 per cent. of fruit, perfectly free from Codlin Moth. Mr. Hargreaves sprayed fourteen times, and many of his apple trees, loaded with fruit, were absolutely without an infected apple. Messrs T. Somerville (Strathfieldsaye), H. Keck (Bendigo), H. Windsor (Marong), H. Winkelmann (Campbell's Creek), and J. Douglas, H. McLean, and J. Pellas, of Harcourt, as well as many others, all used this spray last season with excellent results. And, as an instance of its continued popularity, a large majority of growers in the extensive apple and pear growing district of Harcourt has this season ordered chemicals for spraying exclusively with this spray.

In conclusion, it may be well to repeat the necessary additional action to be taken in order to keep the orchard free from this pest: Scrape off all loose bark. Fill and plug all holes and crevices in trees. Leave no cracks or broken ends of limbs. Clear away all weeds and growth around trees. Have the bandages examined thoroughly and regularly. Keep fruit houses frequently cleaned and examined for grubs. Allow no second-hand cases in the orchard. Destroy all bags and packages likely to have come in contact with infected fruit. Gather and destroy all fallen fruit. Growers are also urged to accurately measure for themselves their pump casks or barrels, as the reputed measurement is very often the result of guesswork, and hence inaccurate. The result is that the spray is either ineffective, or the tree is burned by the mixture being too strong.

The arsenite of lead spray is not at all an expensive one. With the cost of chemicals at the present ruling rate, it works out at about 6½d. per acre for each spraying, or at a cost of 4s. 4d. per acre for eight sprayings, exclusive of the cost of labour.

DAIRY PRODUCE COMPETITIONS.

The Hon. the Minister of Agriculture has provided £150 towards prizes and medals to be awarded at the Dairy Produce Championship Competitions in connexion with the Exhibition of Australian Manufactures and Products, to be held at the Exhibition Building, Melbourne, during January and February, 1907. Various dairy produce firms, companies, and butter factories have also made liberal contributions towards the prize fund, so that the Committee of Management has been enabled to offer five gold medals, thirty-two A.N.A. exhibition certificates, and £254 in cash prizes.

Entries for the various classes must be lodged on or before the 14th December, with the Secretary for Agriculture, from whom full particulars may be obtained.

GARDEN NOTES.

J. Cronin, Inspector, Vegetation Diseases Acts.

The Pelargonium.

Pelargonium is a family of plants consisting of annual, biennial, herbaceous, and shrubby species, which, with the exception of a few unimportant kinds, are natives of Cape of Good Hope. The original species are rarely cultivated now, except in botanical collections, although several are beautiful in their foliage and flowers. What are known as florists' pelargoniums are hybrids from various species, but, except the zonals, derived from *P. zonale*, a species introduced into England in 1710, and

"ADOLPHE BRISSON"—ZONAL TYPE.

the ivy-leaved, from *P. lateripes*, introduced in 1787, the parentage of the present-day kinds is uncertain. The types of cultivated pelargoniums are: Zonal, commonly but wrongly called geraniums; show; regal or decorative; fancy; and ivy-leaved or climbing varieties. There are also hybrids from various species not generally grown, and variegated leaved zonals.

The popularity of pelargoniums is not as great as twenty years ago, when the various horticultural societies catered specially for growers of these plants, but a distinct revival has occurred in the last few years, especially in the zonal class. A few kinds of this class were always popular on account of their bright colouring, easy culture, and hardiness, and of late many fine new kinds, that are a marked advance in size of flower and

truss, and of a much greater range of colour, have been raised and distributed. In a climate free from severe frosts they grow into large bushes quickly, and are scarcely ever devoid of bright effective flowers. They are also specially suited for pot culture, and will flower freely during the greater part of the year. The variegated varieties are more suitable for pot plants than the open garden. The show and decorative varieties are the most popular as pot plants, and some beautiful specimens are occasionally seen at horticultural exhibitions. They are also worthy of much more extended culture in the open borders, where, when properly treated, they rival azaleas and other popular plants in their wealth of bloom. The show varieties are hardier and neater in habit of growth than the regals, and, though smaller in the trusses and plainer in type of flower, are more floriferous. The regals at their best are splendid flowering plants, but are not often seen to advantage in the open garden. The trusses and individual flowers are larger than in the show kinds, and the petals are frilled and of much greater substance. Fancy, or "ladies'," pelargoniums are a smaller growing type, producing neat trusses of bloom. They were very popular at one time, but are now rarely seen, except in nursery collections. A much more generally grown class are the ivy-leaved or climbing varieties, some of which are among the most effective and rapid growing of climbing plants. These are specially useful for covering unsightly places in the garden, but one drawback to their general value is their liability to become a harbor for snails.

Culture.

Pelargoniums of all classes require sweet, well-drained soil, whether cultivated in pots, boxes, or open ground. They will endure a deal of drought without suffering greatly, but will not thrive if planted in sour, wet soil. The most suitable soil is a fibrous loam, with sharp sand added for pot culture. Well-rotted horse or cow manure should be added to potting soil, but except in the poorest of soils no manure is necessary for open ground culture, especially in the case of the regal varieties. Fine specimens are occasionally to be seen growing in poor sandy soil, flowering splendidly in season; but when heavily manured, and liberally watered in summer, gross growth is produced at the expense of bloom. Plants may be set out from pots at any time in the growing season, early autumn being the most suitable. This is also the best time to transfer plants to different stations in the open ground.

Pinching the point out of the leading shoots is all the pruning needed to shape young plants, causing them to break into lateral growth. Plants may be retarded in their time of flowering, and also furnished into well-shaped specimens if thin and leggy, by pinching the points of the growing shoots in spring. After the flowering period, pot-grown plants should be placed in full sunlight, and water used sparingly, to ripen the growths. These growths should be thinned out and pruned back, leaving about 2 or 3 inches of the shoot. To make nice specimens for the following season, shoots of equal size and at equal angles from the main stem should be retained, if possible. In the open ground the same treatment should be followed as far as practicable. In the case of zonals very little pruning is needed. An occasional thinning when the plants are becoming crowded, and pinching the top of an extra vigorous shoot, will keep the plant in shape.

Pelargoniums are propagated from cuttings of the ripened shoots, inserted at the pruning time. The cuttings should be about 3 or 4 inches in

length, the bottom leaves removed, and the shoot cut cleanly across with a sharp knife close below a joint. They may be inserted in pots, boxes, or the open ground. A sweet soil without any fermenting material is most suitable; sand placed at the base of the cutting improves the ordinary chances of rooting. No manure whatever should be allowed near the base of cuttings of any plants. The cuttings when rooted may be potted and grown on for a time, or may be placed at once in the position selected for them. Cuttings of zonals may be inserted at almost any season. Gross

"PERSIMMON"—REGAL TYPE.

sappy shoots should not be selected for cuttings. New varieties are raised from seed, which is easily saved, and plants can be raised without much trouble. If good varieties are inter-crossed fair results may be expected.

Varieties.

The following are desirable varieties:—

Regals.—Her Majesty, Madame Thibaut, Duchess of Bedford, Empress Frederick, Edward Perkins, Captain Raikes, Persimmon, Queen Victoria, Dorothy, St. Visto, Cremorne, Le Grand. Emperor of Russia, Gold Mine.

Show.—Claribel, Isabel, Embassy, Argus, Lady of the Lake, Mabel, Conductor, Diplomatist, Maritana.

Zonal.—Single: Adolphe Brisson, Conan Doyle, M. H. Tilmant, Maud of Wales, Snowdrift, Mary Pelton, Charles Recolin, Barbara Hope,

Dryden, Dr. Nansen, Miss Fenn, Louis, Chaucer, Rev. F. Atkinson. Double and semi-double: Australian Gold, Charles Gounod, Fraicheur, Golden Gate, Huber Charron, F. V. Raspail (improved), Hartwig Buchner, Kleber.

Ivy-leaved.—Souvenir de Charles Turner, Beauty of Jersey, Abel Carriere, Ryecroft Surprise, Jeanne d'Arc, Future Fame, l'Elegante, Multiflora.

Flower Garden.

General gardening work of importance during this month is the continuance of surface cultivation, watering when necessary, and staking and training growing plants. Where water is needed it should be applied thoroughly, a light surface sprinkling being of little service, and often decidedly harmful, as roots are encouraged too near the surface, where they will be injured by cultivation. A good soaking is necessary, and the surface should be broken finely again as it is drying. Plants that specially need water during dry weather are those newly planted, and surface rooting kinds, such as ericas and azaleas. When free growth is being made the plants should not be allowed to suffer from lack of water, but those with matured foliage rarely require it at this season, except under speciallv severe conditions. Plants such as violets, primroses, and other winter and spring flowering species, require no water, being in a state of comparative rest at this time.

After the spring flowering is over, roses should be allowed to rest—*i.e.*, should not be forced into growth by the free use of water. Ordinary surface cultivation will suffice in the case of established plants, or in very dry situations a mulch of stable manure. Weakly growths may be cut away, and ample room should be allowed for the development of the remaining shoots.

Dahlias should be planted this month. If beds have been prepared for them, the plants may be set out in late districts early in the month. The end of the month is preferable for the metropolitan district, and early districts where there is no danger of early frost. Divisions of the tubers may be set out a week or two later than young green plants from pots, and then flower simultaneously with them.

Care should be taken not to break the "ball" of soil when planting green plants from pots, and some shelter should be provided for a few days should the weather be hot. A pot inverted over the plant, or a rough shading of bracken or such material, is sufficient. Plants in pots should be thoroughly watered before being "knocked" from the pots, and the young plants carefully watered, if need arises, for a few days.

Chrysanthemums should be tied to stakes as growth develops. All lateral growths, where large blooms are desired, should be removed as they appear. Very little water is necessary where the plants are growing fairly. Steady growth should be aimed at.

Kitchen Garden.

The hoe or other cultivator should be kept going between rows of growing crops. Water should be applied during hot, dry weather before the young plants actually suffer. Water should not be applied overhead on hot days. Tomatoes should be tied to stakes or trellis as growth develops, and lateral growths removed. A few of the strong growing varieties, such

as Ponderosa, set their fruit better when trained on a trellis at sharp angles from the upright; tied to stakes, or trained perpendicularly, they grow too vigorously to fruit well. Shy bearers are also stopped occasionally at a joint above the one carrying the flowers, the check causing the fruit to set. Should the larvæ of the tomato moth attack the plants, they should be sprayed with a solution of Paris green. at the rate of 1 ounce to 12 gallons water; milk of 1 pound fresh lime should be added, and the mixture kept thoroughly agitated while being applied.

Seeds may be sown for a succession of various saladings, peas, beans, &c. Plantings may be made from former sowings, choosing a dull day, if possible, for the purpose.

THE RASPBERRY.

James Lang, Harcourt.

The raspberry is essentially a cool climate fruit, and will only succeed in those districts which have a considerable elevation and a moist climate. The Dandenong Ranges and the ranges around Kinglake is the ideal home of the raspberry. It succeeds best on a deep loamy soil, and will also do well on alluvial soil of good depth; soil of a dry, sandy nature is the least desirable. Raspberries bring in a small return the first year of planting, and are therefore very suitable for small growers, who must have a return for the labour and capital expended as soon as possible. When choosing a situation for a raspberry plantation, see that it is sheltered as much as possible from hot winds, which sometimes cause great loss to the grower in a hot dry spring.

Preparing the Land.

In preparing land for planting, it should be deeply ploughed to a depth of at least 8 inches, and allowed to lie fallow till the autumn. During the summer the ground should be stirred occasionally with the scarifier to destroy the weeds as they appear, and about the beginning of April the ground should be again ploughed and harrowed down level; it is then fit for planting.

Planting.

The plants should be put out in rows 6 feet apart, and 4 feet apart in the rows; this gives plenty of room to work the ground with the horse-hoe. The young plants are usually suckers obtained from an old plantation. Be careful to select plants from a healthy root stock, as plantations which have been growing for a number of years are sometimes diseased, and young plants from such a source rarely do well, as it takes them two or three years to get into a healthy state again. Three suckers should be planted together about 6 inches apart; this forms what is called the stool. If the plants are put in early during May or June a nice little crop will be obtained the first year.

Cultivation.

This will mainly consist of keeping the ground clean with the horse-hoe, and thinning out the young suckers in the spring. The plants generally produce a quantity of suckers that are not required, and if these are left they soon exhaust the soil, robbing the plant of nourishment that should go

towards maturing the fruit. They should, therefore, be thinned out, leaving just sufficient to form canes for the next year's crop of fruit. When the fruit is all gathered, the old canes should be at once cut out; this leaves more room for the young canes to develop.

About the month of June the ground should be ploughed; throw the furrow up to the plants, leaving a furrow down the middle of the row. This drains surplus water off during the winter. About October the ground should be ploughed the reverse way from the plants towards the centre; this leaves a narrow strip which should be levelled into the furrow with a heavy hoe. In a week or two run the horse-hoe up and down the rows, so as to leave the ground perfectly level and in a good state of tilth.

PRUNING, MANURES, &c.

During the winter all surplus suckers should be removed, leaving four strong fruiting canes for the second year's crop. These should be topped to a height of about 5 feet. The following and each subsequent year, six canes may be left for fruit bearing, all others being removed. Stakes should be put in at each stool in order that the canes may be tied up.

The gathering of the fruit extends over several weeks, as the fruit ripens very irregularly. It is, therefore, necessary to gather the ripe berries two or three times a week.

Manure should be supplied to the plants after they have been bearing two or three years. Where farmyard manure is not available, one of the many orchard manures on the market should be used at the rate of 4 cwt. per acre.

The varieties mostly grown are Northumberland Fillbasket, Fastolf, Red Antwerp, Semper Fidelis.

THE PROCLAIMED PLANTS OF VICTORIA.

(Continued from page 688.)

Alfred J. Ewart, D.Sc., Ph.D., F.L.S., Government Botanist; and J. R. Tovey, Herbarium Assistant.

Nut Grass.

Cyperus rotundus, Linne. (Cyperaceæ.)

Stem ½ to 1½ ft. high, from a short, sometimes creeping, rhizome, the fibrous roots occasionally forming small tubers. Leaves flaccid, much shorter than the stems. Umbel-rays not numerous, the outer leafy bracts seldom so long as the longest rays. Spikelets, very narrow, sharply pointed, varying from 1 to 2½ lines in length, 3 to 8 together, in short spikes at the ends of the rays. Glumes numerous, overlapping, a narrow egg-shape, scarcely pointed, red-brown, with a green keel and light-coloured edge. Style long, 3-cleft. Nut much shorter than the glume. Widely diffused over the tropical and temperate regions of the New and the Old World. It is a troublesome pest in farms and gardens. Continued hoeing in cultivated ground would help to suppress it, but the rhizomes and tubers should be dug out, dried, and burnt. Proclaimed under the Thistle Act for the whole State.—September, 1892.

(To be continued.)

PLATE 7

ARTIFICIAL FERTILIZERS AND THEIR USE IN MARKET GARDENS.

F. E. Lee, Agricultural Superintendent.

Some months ago inquiries were instituted among the market gardeners in the East, North, and South Brighton, Cheltenham, Caulfield, Oakleigh, Clayton, and Spring Vale districts, with a view to ascertaining the practice generally pursued in the use of artificial fertilizers for the production of vegetables. One hundred market gardeners were visited, viz.:—

East Brighton ...	36	Caulfield	4
North Brighton ...	10	Oakleigh	1
South Brighton ...	30	Clayton	9
Cheltenham ...	9	Spring Vale ...	1

The following set of questions was asked in each case:—

1. What amount of stable manure do you use?
2. Do you use it on all crops?
3. Do you use any artificial manure in conjunction with the stable refuse, and, if so, what kind, how much per acre, and on what crops?
4. Do you use any different method of fertilization for special crops?
5. Do you use any artificial manures for top dressing, and, if so, what kind, how much per acre, and on what crops?
6. Is the garden naturally or artificially drained?
7. What is the nature of the soil?

These questions were put to elicit definite information, and it is on the general answers to these queries that this report is based.

The Object of the Inquiry.

The objective of the inquiry was to discover if it would not be possible to so amend the present use of artificial manures that the same—or, possibly, better—results might be obtained at a less cost. It is a common error to think that, because moderate amounts of artificial manures produce increased returns, that four times the amount should increase the returns fourfold, or nearly so. That such is not the case is not difficult to prove. For example, a plant requires some ten or twelve different substances for its successful growth. Out of these there are, as a rule, only four which require renewal by artificial means, viz., nitrogen, phosphoric acid, potash, and lime.

A plant, however, has a certain amount of selective power, and does not draw upon any one ingredient to a greater extent than its demands require; therefore a light dressing of fertilizer is frequently just as effective as a much heavier one. This fact is exemplified in the manuring experiments carried out by the Department of Agriculture over a term of seven or eight years in the wheat-growing areas, where it has been abundantly proved that a dressing of 56 lbs. of superphosphate per acre produces superior yields to a dressing of 75 lbs. of the same manure. Furthermore, the addition of manures containing nitrogen, and also of potash, has even resulted in the lowering of the yields of grain, showing that the crop has been over-manured. The question naturally arises: What becomes of the surplus foods that the plant does not use? The answer is that a portion of the nitrogen which has been transformed into nitrates by soil agencies,

being very easily soluble, is leached out of the ground, and goes away in the drainage water. The phosphoric acid and potash find certain bases in the soil, with which they unite, and turn into forms that are not soluble in water. When one reflects that the plant can only utilize food that is held in solution, it becomes clear that all insoluble material is of no service to plant life.

The ideal system of manuring would be to supply the plant with just so much food as it could utilize, and no more. We find, however, that in practice this is difficult to arrive at. The amounts of the plant foods removed by a crop of vegetables are so small that, if we were to restore only what is removed by the crop, it would be difficult to efficiently distribute the commercial forms in which the plant foods occur. To insure uniform distribution it is therefore customary to give an abundant supply. An abundant supply, however, does not mean extravagant use. The force of my argument will perhaps be made clearer by reference to the following table, which shows the amounts of the fertilizing materials removed by one half-ton of some common vegetables:—

Vegetable.	Water.	Nitrogen.	Phosphoric Acid.	Potash.
	lbs.	lbs.	lbs.	lbs.
Cabbage	905	3 8	1·1	4·3
Cauliflower	906	2·6	1·6	3·6
Carrot	886	1·6	0·9	5·1
Parsnip	803	2·2	1 9	6·2
Turnip	904	1·8	1·0	3 9
Radish	933	1 9	0 5	1·6
Horse Radish	767	3·8	1·3	9·5
Lettuce	937	2 3	0·7	3·7
Celery	841	2 4	2·2	7·6
Cucumber	958	1·6	1·2	2·4
Pumpkin	900	1·1	1·6	0·9
Onion	870	2·7	1 3	2·5
Pea	126	35·8	8·4	10·1
Tomato	936	1·6	0·5	2·7
Potato	750	3·4	1·6	5·7
Artichoke	811	2·9	1 4	4·7
Asparagus	936	3·0	0·9	2·0
Rhubarb	916	1·3	0·2	3·0

The two facts which stand out prominently in the above table are—(1) That nearly nine-tenths of most crops are water; and (2) that the ingredient which is removed in greatest amounts by almost every vegetable is potash. The latter fact supplies an adequate reason for the whole inquiry.

The General Practice with Manures.

With one exception, where night-soil was made use of, the invariable practice is to use stable manure in amounts ranging from three to twelve tons, or even more, per acre. The amount available seems to regulate the quantity used. The treatment for most crops is the same, except for potatoes and other root crops, where an addition of bone-dust or blood manure (sometimes both) is used. Top dressing is practised to a large extent for the forcing of such crops as cabbages, cauliflowers, onions, lettuce, &c., and especially is this the case when, through one reason or another, these crops are backward. Nitrate of soda, or sulphate of ammonia, at the rate of ¾ cwt. per acre, is the manure generally used.

Many of the gardens are drained by tiles; others depend on the natural drainage of the sandy soil. It appears to be generally conceded that artificial drainage is necessary to give the best results. The use of potassic manures is conspicuous by its absence. In only two cases out of a hundred was there any mention made of potash being used; in both cases the results had not been satisfactory. It is possible that the potash may not have been in the most suitable form, nor the amount used sufficient; or it may have been used on the wrong class of plants, and perhaps at the wrong season. All these factors would influence the result of its use. The light sandy type of soils to the south-east of Melbourne is naturally poor in potash, so that the relatively large amounts removed by continuous vegetable cropping can only be restored by one means, viz., the stable manure.

THE ANALYSIS OF STABLE MANURE.

Stable manure is a substance that is liable to be affected by so many influences, such as the kind of animal supplying it, age of animal, kind of food—whether fresh or rotted—kind and amount of bedding, &c., that we can only accept the average of a very large number of analyses as being being fairly accurate. If we assume that 1 ton of average stable manure contains nitrogen 8 lbs., phosphoric acid 6 lbs., and potash 6 lbs., and that the average annual dressing used by the market gardener is 6 tons per acre, we should find that the following fertilizing ingredients were annually supplied:—

Nitrogen.	Phosphoric Acid.	Potash.
lbs.	lbs.	lbs.
48	36	36

The equivalent of these materials is furnished approximately by—

Nitrogen.	Phosphoric Acid.	Potash.
3 cwt. Nitrate of Soda, or, $2\frac{3}{8}$ cwt. Sulphate of Ammonia	2 cwt. Superphosphate, or, 2 cwt. Bone-dust	$\frac{2}{3}$ cwt. Muriate Potash, or, $\frac{3}{4}$ cwt. Sulphate Potash, or, 3 cwt. Kainit.

It is usual to supplement the average dressing of 6 tons of stable manure, in a great number of cases, by about 5 or 6 cwt. of bone-dust or blood manure per acre. The amount of fertilizing material thus put at the disposal of the plant may assume large proportions, as follows:—

——	Nitrogen.	Phosphoric Acid.	Potash.
	lbs.	lbs.	lbs.
Supplied by 6 tons Stable Manure ...	48	36	36
,, 5 cwt. Bone-dust ...	$17\frac{1}{2}$	110	—
Total	$65\frac{1}{2}$	146	36
Or,			
Supplied by Stable Manure	48	36	36
,, 5 cwt. Blood Manure ...	55	4	1
Total . .	103	40	37

If the reader refers back to the table which sets out the amounts of the plant foods removed by various vegetable crops, it will be seen that a very great excess is supplied over the demands of the plant. The analyses alone of the plant, as a guide to manurial deficiencies, are likely to be misleading; but there is sufficient justification in saying that the present amounts of artificial manures supplied are not only excessive, but badly balanced as well. For example, the plants show that, almost without exception, they remove more potash than any other ingredient, whereas the manures, both natural and artificial, restore that ingredient in the smallest amounts.

Suggestions for a Remedy.

The use of stable manure cannot be too highly commended; but its usefulness is more in the direction of improving the physical condition of the soil than as a direct supplier of plant food. Light sandy soils are deficient in "body," and require vegetable matter, or humus, to enable them to retain moisture. Heavy clay soils, on the other hand, are difficult to work, and require breaking down to facilitate the passage of moisture, air, and warmth. By classifying the commoner vegetables into the groups to which they belong we may arrive at a little understanding of their dominant demands:—

Cole Crops—Cabbage, cauliflower.
Root Crops—Carrot, parsnip, turnip, horse-radish, radish.
Salad Crops—Lettuce, celery.
Curcurbitous Crops—Cucumber, pumpkin.
Bulb Crops—Onion.
Pulse Crops—Peas.
Solanaceous Crops—Tomato.
Tuber Crops—Potatoes.
Perennial Crops—Artichoke, asparagus, rhubarb.

It will be remembered that almost every group is a strong potash feeder. The excessive amount of nitrogen in the pea is largely accumulated from the air, so that direct fertilization in this respect is unnecessary. The pea plant is a strong potash feeder, and should be aided in that direction as much as possible. Seeing that most of the vegetables commonly grown make such demands on the potash supply, it is worth considering how best to meet the needs of the plant in this respect.

The cost per ton of the potassic manures on the Melbourne market is high, viz.—

£13 10s. for muriate of potash or potash chloride;
£14 10s. for sulphate of potash; and
£5 for kainit.

The last-named is hardly to be recommended for vegetable growing, on account of its admixture with common salt. Potash chloride contains from 58 to 61 per cent. of pure potash, and potash sulphate 48 to 52 per cent. The former is, perhaps, the more easily soluble. A "complete" manure (one containing the three principal plant foods) might be made up on the following lines as a basic dressing for all vegetable crops:—

1 cwt. sulphate of ammonia,
3 cwt. superphosphate and bone-dust (in equal quantities),
1 cwt. potash sulphate.

For special crops, however, such as may require forcing for the early market, the addition of 1 cwt. of nitrate of soda as a top dressing may be necessary. The nitrate should not be used until the crops have made a certain amount of growth, because, being extremely soluble, it has a tendency to rapidly leach out of the soil. If the root system of the plant is fairly abundant, it uses up a great portion of the nitrate of soda before it escapes. For this reason, never top-dress with nitrate of soda, if it can be avoided, either just prior or just after heavy periods of rain. The combination of the three manures will be found to assist the working of one another.

CONCLUSION.

Reviewing what has been said in a general way, it will be clear to the person who is desirous of getting the most out of his land that the rational use of artificial manures means a clear knowledge of the dominant wants of each class of crop; the functions of the different plant foods—*i.e.*, the part each one bears in producing a perfect plant—the differences which exist between various forms of commercial fertilizers which contain the same ingredient—such, for example, as superphosphate, Thomas phosphate, and bone-dust; why one should be used, and not the other; why one may be sown in the early autumn, and another may not be used till the spring. A better understanding of the aids to production means economy in money without any deterioration of the output, but rather an improvement in the quality of the product.

THE IMPROVEMENT OF VICTORIAN PASTURES.

FEEDING CLOVER SEED TO CATTLE.

It is commonly observed that pastures become well clothed with grass and clover through the way these seeds germinate in the droppings of the animals. The question has been asked as to whether it will pay to feed such seeds to cattle, with the object of improving the pastures. The following letter from Mr. E. Simpson Hill, Field Officer, speaks for itself:—

"Mr. Young's land at Longwarry is on the poorer soil of the swamp fringe. His method is to sprinkle a handful of mixed clover seed (White Dutch, Cow Grass, and Alsyke) amongst the chaff he feeds to his milking cows. He does not harrow the droppings about in the paddock, but just lets them lie. The result is that he has a fine growth of clover all over his paddocks where none grew before, and where he has even tried to get it to start by hand-sowing, but failed. He attributes the success to the action of the cow's stomach upon the seeds which are partly germinated, and to the plant food which is immediately available upon complete germination. He thinks but few seed are lost in the chewing of the cud, is well satisfied with his experiment, and believes it to be the best way of sowing clover on almost any soil."

TURKEYS, THEIR CARE AND MANAGEMENT.

H. V. Hawkins, Poultry Expert.

In response to inquiries for hints on the management of turkeys and the cause of many fertile eggs not hatching, I intend to briefly outline a few points of primary importance in connexion with their habits, &c.

In the first place, the Turks had little, if anything to do with this breed, so that the name "Turkey" was not given this excellent table bird by them, but rather by the Americans. Personally, I am inclined to the belief that the Mexicans discovered the wild turkey, but the credit of vastly improving and domesticating it, and raising the breed to the present standard of perfection rightly belongs to the Americans. In any case, I am content to know that the Americans have farmed turkeys for so many years, and have wonderfully changed their type, colour, and habits, with such splendid results.

The question so often asked is, "Why turkey farming has been so long neglected here?" Those who have done most for the Commonwealth in this regard, have been the squatters, who, in many cases, merely keep a few at first to supply a change of menu from mutton. They have little time to devote to the care of these birds, still, in most cases, the result has been great success. The reason is not difficult to find, *i.e.*, turkeys, being great travellers and foragers, must have acres. They may be seen in large flocks in the Riverina miles from the station homestead. They have a decided objection to being fed on wheat morning and evening. I have taken particular notice of their method of feeding, and have invariably found that they had good appetites when variety of food abounded, *i.e.*, first a seed, then an insect; possibly a grasshopper would cross their track, and a bad time the grasshoppers get when a flock of 200 bronze turkeys sets sail.

Best Breeds to Farm.

The bronze turkey being large, and the flesh so beautifully white and succulent, is perhaps the breed *par excellence*, yet it should be always borne in mind that the 40 lbs. gobbler is not the most profitable to breed. Birds of 14 to 18 lbs. weight are usually those which the consumer prefers, provided sufficient flesh is presented to the chef by which he can satisfy a fairly large number of visitors. The black turkey gobbler of good size, and two years at least, and unrelated, and twelve to thirteen large bronze hens (two years old), make an ideal breeding flock. Many add a very large bronze gobbler, which is unsuitable for the hens, non-fertilization of the eggs being the result. Each hen averages eighteen to twenty eggs before going broody.

Turkeys need little attention if kept away from fowls and ducks. Turkey farming pays best by itself, and the northern areas are more suitable than the southern. They lay their eggs in a secluded spot; a cement barrel laid on its side with a brick each side to prevent rolling, and a branch of a tree partially covering its entrance, is all they want to encourage them. It is best to permit the eggs to remain in the nest. The hen is usually very cautious on entering and leaving her nest, and seldom breaks an egg, unless she has not had sufficient shell formers in her diet.

See that she gets ample cinders, burnt bones, and charcoal, and, when possible, plenty of dry oyster shell. Much depends on the farmer whether she breaks the egg and hatches her young.

MAKING NESTS, ETC.

Always provide the hen with an inviting spot and plenty of green grass for the nest; a too dry nest often causes trouble—lack of moisture. In

A TYPICAL TURKEY GOBBLER.

districts in the far north I would strongly urge that one side of the barrel be removed; make the nest on the ground, oval in shape, and keep a fair amount of moisture around the nest. Give the hen opportunity to dust herself in a damp spot; she will get it if possible, and there will be little fear of dead chickens in the shell unless breeding from immature birds is practised. A gobbler at twelve months is not the best. He should be at least two years old; likewise the hens. Above all, introduce fresh blood every second year; this is of great importance in the raising of turkeys for

profit. Again, a vigorous gobbler will fertilize all the eggs of a dozen hens in less than four weeks; that is to say, suppose a turkey hen, after she has had the companionship of her mate for say a month, lays seventeen eggs at a stretch, the whole batch laid prior to her brooding will be fertilized. In short, you need only borrow a good gobbler for one month in the season, provided you are not hatching late chicks. See that his toes are not like a razor, otherwise serious results may follow; I have, this season, stitched three beautiful bronze hens, the backs of which had been laid bare.

Of one thing there can be no doubt, turkeys do best in the fresh air, and will not stand coddling; they should be housed in large airy sheds, open completely on the eastern side, with perches fairly wide (three to four inches). The straighter the breast bone, the better satisfied will the consuming public be, and narrow perches mean crooked breast bones. Do not place the perches too high, especially where the ground is hard or stony, as turkeys are, like fowls, subject to bumble feet, which often spoil hens for a whole season. I am quite convinced that turkeys must be encouraged to accustom themselves to shed roosts; they prefer the limb of a tree or the top of a harvester, but that should not be. A little coaxing for a week, a kindly bucket of oats by way of encouragement, will do much to form the habit of coming home each night at dusk, instead of their straying away, or being found in the field in the morning with their heads off—the work of foxes, which are very troublesome in most districts.

FEEDING TURKEYS.

The adult birds usually find most of their own food, yet it is an absolute necessity to feed the flocks when natural foods are not available, *i.e.*, in the autumn and winter they get down in condition if not attended to, although they may have unlimited range. Insect life is then scarce, grass is of poor quality, and is also usually wet, and the consequence is they scour and often die from the effects. Barley meal, maize meal, and bran (one part each), with a fair amount of chopped up boiled rabbit, and when available a few sliced up raw onions, all mixed with the soup in which the rabbit or other animal food has been boiled, should be used. Mix as dry as possible, turkeys do not thrive on slops. Curded milk is much relished, and is a splendid flesh former, and a whitener of flesh; nothing is more objectionable than a *fatty* breast. Too much maize feeding, or a constant supply of wheat, will not improve the colour of the flesh. Oats are by far the best of the grains to assist in keeping down fat.

Fresh Water.—Always provide fresh clean water daily, and keep the vessel out of the sun; neglect in this regard will cause losses by disease. Add charcoal in case of bowel disorders; it is an absolute necessity in successful turkey raising.

Grit.—They must have an unlimited supply of grit, without which they suffer much from indigestion. Small pebbles, coarse sand, and pieces of broken crockery, and smashed up burnt bone all aid in digesting their food; this is especially required prior to their going to roost.

Boiled Grain.—There is no necessity to boil any grain; they are better without it, and prefer the hard food to that of a sloppy nature.

Egg Producers.—The so-called "egg producers," mentioned by some of my correspondents, would, if fed in sufficient quantities, in some cases assist egg production, but at what a cost? The best egg producer is insect

life, and when not available in sufficient quantities, add the best substitute, *i.e.*, beef and mutton scraps, sheep or bullock's liver, or rabbit, soaked in cold water overnight, and then lightly boiled. Use the liquid for mixing the morning meal, and avoid making it pasty, but use the hands well in mixing it hard and friable. Curded milk when available should be a magnificent aid to egg production, and when topping turkeys off for market, give them as much as they will take, as it softens and whitens the flesh; milk fed turkeys eat like six weeks old chickens.

Young Turkeys.—For young turkeys many successful raisers use hard boiled eggs mixed with stale bread crumbs, and a little fine oatmeal, moistened with skim milk (crumbly, not sloppy). This is given the very young chicks for the first week, after which eggs should *not* be given, but plenty of finely pulped raw onion added, and with it milk curds, and a little dry bone meal and charcoal mixed well through. This not only keeps their bowels in order, but supplies the additional phosphoric acid necessary to quick growth of bone, and increases stamina, thus decreasing the chances of "leg weakness," a complaint to be guarded against. Encourage the very young turkeys to eat millet seed at night, and after two weeks feed on hulled oats for best results, until old enough to have a little wheat or oats.

Keep the young turkeys dry. Nothing kills quicker than long wet grass; once they get a soaking, deaths may be expected. Always keep them in confined pens, well sheltered from wind and rain. Do not on any account allow them on the dewy grass, but keep them in until the sun has dried the grass off a little. Examine all young poults for vermin, which is so troublesome at the back of the head and near vent; hundreds of birds die through no other cause. The pest is similar in habits to the tick, holding on and penetrating the skull. The young birds should be freely dusted with insectibane, and a little carbolic paste applied at the back of the head. Neglect in this matter is the cause of many deaths. The fact that late hatches do not develop as fast as the early hatches is of the utmost importance to all farmers of poultry, be it turkeys, ducks, or fowls. The early chicks may be relied on to produce the best results. The longer a hen lays in a season, the more impoverished she becomes as a result of hard work. Thus we find the embryo becomes smaller and weaker, and it is from these late poults we get bad symptoms, first catarrh, often the precursor to a more serious trouble, *i.e.*, roup, or to make it clearer, a running at the nostrils is observed, and later, symptoms show a swollen head, from which arises an offensive smell.

' Onion tops, dandelion, rape, and raw onion finely cut, and white clover, are without doubt the favorite green foods with turkeys; and they are rich in mineral salts, and valuable as correctors of the blood. From five weeks old and on, this can be given mixed in the morning food (pollard, bran, &c.)

If the pasture has a variety of grasses, so much the better, as they prefer variety, but if it be a dry droughty spot, sow lucerne in a 1-acre enclosure. After it becomes established, it will keep you supplied with green summer food, being rich in protein, and also an egg producer.

Area.—One hundred adult turkeys could easily be run on five acres, but, unless the owner is compelled to fence, I would advise giving them full liberty, as they will not require so much feeding. It is rather difficult to say whether three feet and three added wires on top will suffice to keep

turkeys in; much depends on the way they have been brought up. If at all wild fifteen feet would not keep them in without doctoring the wing joint.

Domesticated poults are usually tamer than Leghorns, and give less trouble in this respect. I would certainly recommend trying 3-ft. wire, with four plain ones above, but care should be taken when putting in posts. Do not use too thick a post, for this reason, that if the posts are "table-topped" they allow ample room for a gobbler to fly on to; the others will soon learn the habit. Further, wide top posts are a source of great danger where foxes are plentiful. Run the wires above the thick posts, attached to thin hardwood batten. One morning I saw fourteen headless turkeys in a 5-acre enclosure at Buninyong, and traced Mr. Reynard's hair on a thick 6 ft. high corner post, which was 25 inches in circumference at top, and unbarked. Had the barbed wire covered the top of the fence this loss would not have occurred.

I would strongly advise all of my readers who have acres in the Riverina, Wimmera, or Goulburn Valley, to raise turkeys for market, as they will pay equally as well as lambs. Recently at Geelong I saw prime gobblers realize from 22s. to 27s. per pair at auction. A leading Melbourne firm also informs me that prime turkeys, topped off with a good handful of short white oats at night two to three weeks before marketing, will always command top places. During Show week, and prior to Cup week, turkeys sold at their rooms up to 25s. and 27s. 6d. per pair. Dr. Wight, of Kyabram, makes a hobby of raising turkeys, no less than 150 birds being raised successfully by him during last season. Mrs. Goddard, of Moama, has also had great success with them.

The main thing in marketing is to top off and to grade the birds according to size, not putting three big gobblers in a crate with five or six wasters. Mark your crates first, second, and third quality, and you will be quite satisfied when account sales come in. Make the agent your friend, it creates confidence, and he will do his best for you; the farmer who is always chopping and changing about makes a serious blunder. Keep in touch with your salesman; tell him how many birds you will have for disposal, and ask him to wire you when a scarcity of white flesh exists. Don't rush him with twenty crates when ten will suffice; the agent usually knows when to advise you to send, and the cost of a telegram often pays.

BIRD'S-FOOT TREFOIL.

Constable A. C. Dungey, Crown Lands Bailiff, Birregurra.

Bird's-foot trefoil, although brought into this district about forty years ago by a Mr. Hager, who took up land at that time on the Retreat, about 10 miles from Birregurra, has only of recent years attracted much notice. The seed was brought from Germany, and planted by Mr. Hager in his garden, from which it spead over the adjacent lands. Later on the property was purchased by Mr. Armytage, whose manager, Mr. E. Hayes, about eighteen years ago let one of the paddocks to Mr. H. Gladman. The latter, when ploughing the ground for the purpose of growing oats, had difficulty in doing so, owing to the great mass of roots. The attention of Mr. Hayes was drawn to it, and he noting that the plant was kept so close by stock, and that when protected it grew so strong—it

choked the oat crop—decided to submit specimens to the then Government Botanist (the late Baron von Mueller), who identified the plant as *Lotus corniculatus*. Mr. Hayes had the paddocks of the Ingleby estate planted with the trefoil, and recently he has planted it on his own land.

After Mr. Gladman left the Retreat he selected land at Forrest, where through sowing the trefoil, or through the hay grown on the Retreat being used there, that portion along the east branch of the Barwon, which runs through the property, became covered by it. The land was subsequently abandoned, and was lying idle and open for some years. It became a favorite haunt for stray cattle; working bullocks from saw-mills in the locality could not be kept off it, and owners of these stock soon discovered that the trefoil was the attraction. On the Crown lands in the locality where these cattle were wont to run and work, the plant has become established through their droppings. About five years ago Mr. H. Duck went to Forrest, and rented the unoccupied house. He kept a cow, and although there are only about 3 acres of good land on the block, he found the cow did so well that he obtained additional stock, purchased the property, and then turned his attention to cultivating the trefoil. He did this by transplanting the roots on to the poor bracken land, and scratching in seed here and there. The result has, no doubt, been a surprise to himself and all who know the property, which was looked upon as one of the poorest selections in the forest. He has about 40 acres enclosed; on this he has milked twelve cows and fattened several during the last year. His cows averaged about 10 lbs. of butter a week, and the butcher (Mr. A. Muir) who killed the fats describes them as equal to the best he has had in this district. So pleased was he that he purchased £10 worth of the seed, and had it sown on a selection he owns at or near Boolarra. Mr. A. Sanderson, sawmiller, who has had experience of the plant, his bullocks constantly having cleared out to feed on it, also obtained £10 worth of seed, and put it on his property at Forrest. The seed and plants have been sent from this district by Mr. Duck and other residents for years past, but all those who have it on their land state it came from the Retreat originally. The plant is a very heavy seeder, and in that fact, I think, lies its virtue. It starts to seed in October and November, and continues to do so right into the winter as late as June. I find it prefers to grow in wet places, and is seen along all the creeks, growing on the banks that are submerged occasionally; this may also be accounted for by the fact that stock cannot get it readily at these places, for it is difficult to find it where stock have free access, sheep particularly cropping it bare. It seems to grow in any soil, and will take possession of land covered with rushes, which appear to die out as the trefoil grows among the roots. At Forrest railway station yard, which was excavated out of a hillside, the plant is growing in the yellow clay; in another place, on top of a hill, where the surface soil of an old track, beaten hard with years of heavy traffic, has been washed away, it grew well during last summer, and spread for yards from where the seed was deposited in cow manure.

I have no doubt that this fodder can be grown with advantage in any of the cool districts, and also in dry districts where it could be irrigated. It would do well, I believe, in these districts when once established and rooted to the sub-soil, more particularly if the surface were broken occasionally with heavy harrows, &c., as it seems to improve the more it is torn about. Its roots take a lateral direction beneath the surface, and at

every joint shoots are thrown up to the surface. These shoots stool again, and at all joints touching the ground root very like couch or buffalo grass.

Note.—The Government Botanist states that the fodder plant mentioned by Constable Dungey is the *Lotus corniculatus*, L., variety *uliginosa*, formerly known as *Lotus major*—the Greater Lotus, or the large Bird's foot Trefoil. As indicated in the article, it does well where moisture abounds. The common variety of *Lotus corniculatus*, which is abundant in many English pastures, and which is a smaller plant, rooting less freely laterally, but penetrating deeply, and seeding abundantly, would be better adapted for drier situations, though not able to stand extreme drought. Seed of both forms can be obtained from seedsmen in Melbourne and elsewhere. The variety *tenuis* is of use for sandy soil around sea coasts.—Editor.

DISEASES OF FARM ANIMALS.

S. S. Cameron, M.R.C.V.S., Chief Veterinary Officer.

V.—NOTIFIABLE DISEASES UNDER THE "MILK AND DAIRY SUPERVISION ACT 1905."

(Continued from page 655.)

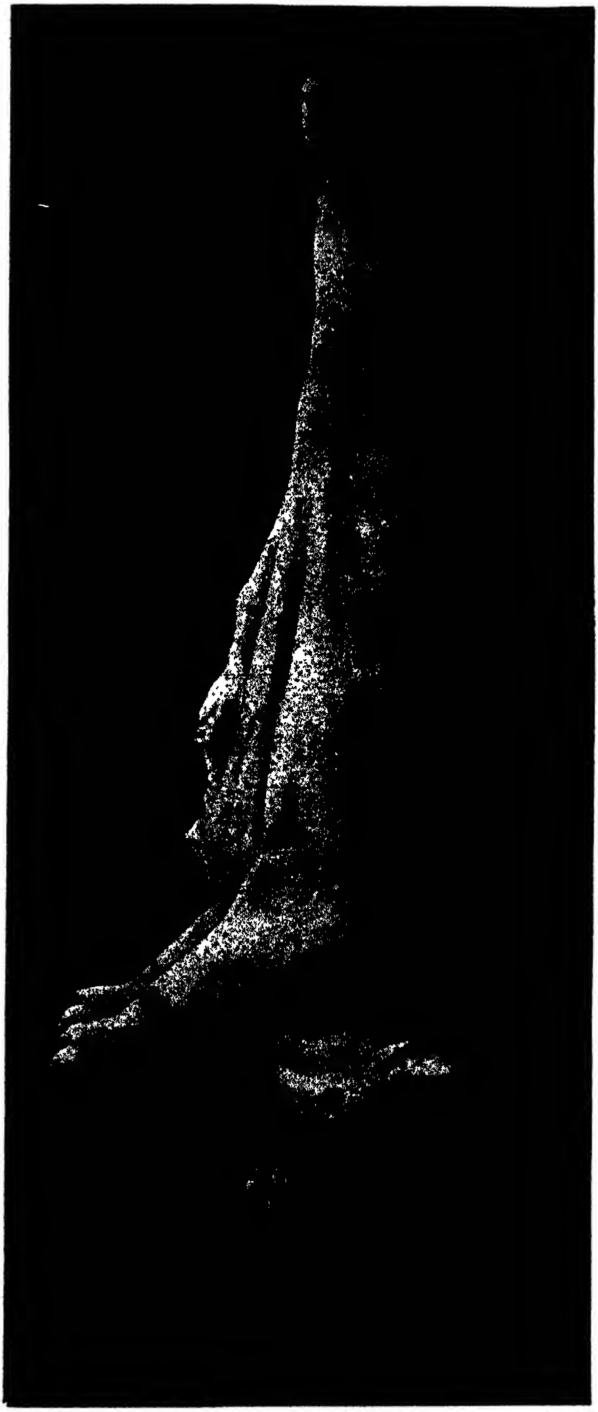
Swine Fever.

Great confusion has existed heretofore, and does even now exist, in regard to the nomenclature and bacteriology of a series of infective fevers in swine, which for practical purposes may be grouped under the common name of "Swine Fever." Amongst these are:—Swine erysipelas, the American "hog cholera," the French "rouget du porc," and the German "Schweineseuche." They all belong to the group of diseases known as the "hæmorrhagic septicæmias"—that group having causative organisms of which the fowl cholera bacillus is the type—and it would appear to matter little, from a practical point of view, whether the diseases so differentiated are actually different, or whether they are simply different manifestations of the same disease, for they are alike infectious and fatal, and the measures to be adopted in dealing with them have consequently to be on the same lines.

This view of the matter was upheld after full discussion at the Inter-State Stock Conference, held in Melbourne, September, 1906, when it was unanimously resolved, on the motion of Mr. A. H. Cory, M.R.C.V.S. (Queensland), for adoption by State Government authorities —

> That for administrative purposes it is desirable that the term "swine fever" be taken as including any of the contagious or infectious diseases of swine of a hæmorrhagic septicæmic character now variously termed "swine fever," "swine plague," "hog cholera," and the like.

The author's complete adherence to the doctrine of the mutability of organisms has been previously indicated, and the view may now be put that these hæmorrhagic septicæmic diseases of swine seem to furnish one of the best examples of that change in character of pathogenic organisms whereby a different manifestation of disease is brought about by the same, though modified, organism. Nocard's earlier view—that swine plague,



I. CARCASS OF PIG SHOWING DISCRETE SPOTS AND PATCHES, SOME BEING RED AND SOME BLACK.

swine erysipelas, and hog cholera might be caused by the same organism, which had become modified in its direction of virulence by environmental, nutritive, or other influences—may be taken as sound, even though, in his later writings, he would appear to have discarded it. It has even been recently suggested by one of Australia's foremost bacteriologists (Dr. Cherry) that the outbreak of Swine Fever throughout the Commonwealth in 1903 may be not remotely connected with the dissemination of fowl cholera organisms which took place during the nineties, when the organism of that disease was used in an attempt to spread an exterminating disease amongst rabbits so little different in characteristics are the organisms of the two diseases.

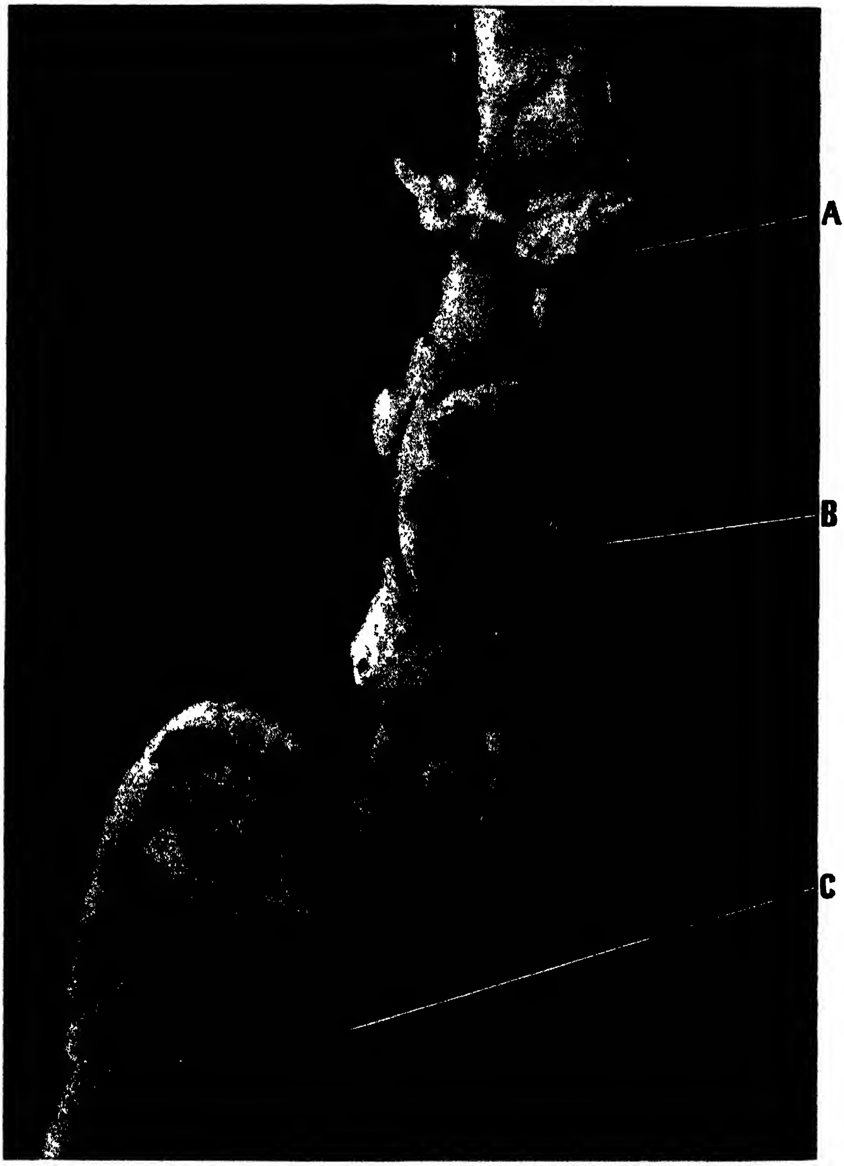
Introduction to Australia.—On the question of the introduction of the disease to Australia various opinions are held, but the view that it has been existent throughout Australia for many years is based solely on speculation and assertion. Not a scintilla of reliable evidence in support of such a view has been forthcoming, while the evidence of its being a new visitation to these shores is convincing to those who had the opportunity of closely studying it at the time of its greatest incidence.

Its behaviour was, at the outset, identical with that of all newly-introduced diseases, in that its virulence was very marked and the mortality exceedingly high. It was no uncommon thing for 80 or 90 per cent. of the pigs in large piggeries to be carried off, and on not a few farms upwards of 200 pigs were lost in the course of a few weeks. After the lapse of three years, however, the usual modification of virulence and mortality has been experienced. The outbreaks are fewer in number and milder in type, and the mortality has been lessened by fully 50 per cent. It must be remembered, too, that Swine Fever was a disease the features of which were familiar to many veterinarians in Australia; yet, until the initial outbreaks in 1903, these features had never been observed or recognised. Then, almost simultaneously* in Queensland, New South Wales, and Victoria the disease was definitely recognised. But the experiences at the Melbourne City Abattoirs were still more eloquent of its being a new disease so far as Australia was concerned. From the commencement of the Meat Supervision Act, in 1901, all pigs slaughtered at the Abattoirs—about 1,000 weekly—had been subject to *post-mortem* inspection in a special manner by a particularly expert officer (Mr. Moog), who, it may be assumed, after experience in the detailed examination of two years' supply of pigs (100,000 carcasses), would be reasonably familiar with the usual or current abnormalities. Yet none of the features of Swine Fever were observed, until suddenly a number of pigs were found, week by week, to present appearances, *post-mortem*, which had never before been seen, and which were the characteristic lesions of Swine Fever. Suppose a life-long peach-grower suddenly found his orchard infested with peach-leaf curl, would he not be justified in regarding the pest as a new introduction, and not that it had been there all along and unobserved by him?

Definition.—Swine Fever may be defined as a specific contagious bacteridian disease of swine, characterized by such successive signs of fever as congestion, ecchymosis, extravasation and necrotic ulceration, particularly of the mucous lining of the gastro-enteric tract, accompanied by fœtid diarrhœa; characterized also by certain circulatory changes of the skin,

* On the question of priority of "discovery" of Swine Fever in Australia, claims have been made which are not justified by the facts. The files of the Board of Public Health, Victoria, contain a memorandum by me of date 16th March, 1903, in which I reported the occurrence of the disease at the Melbourne City Abattoirs.

with a tendency to dermal necrosis, and frequently also by acute pneumonia; and accompanied by a high mortality which, in different



2. ENLARGED ILLUSTRATION OF PORTION OF ILEUM AND CÆCUM SHOWING ULCERS.

A. Ileum. B. Ulcers on region of Ileocæcal valve. C. Cæcum.

countries, has ranged from 50 to 80 and 90 per cent. of the animals affected.

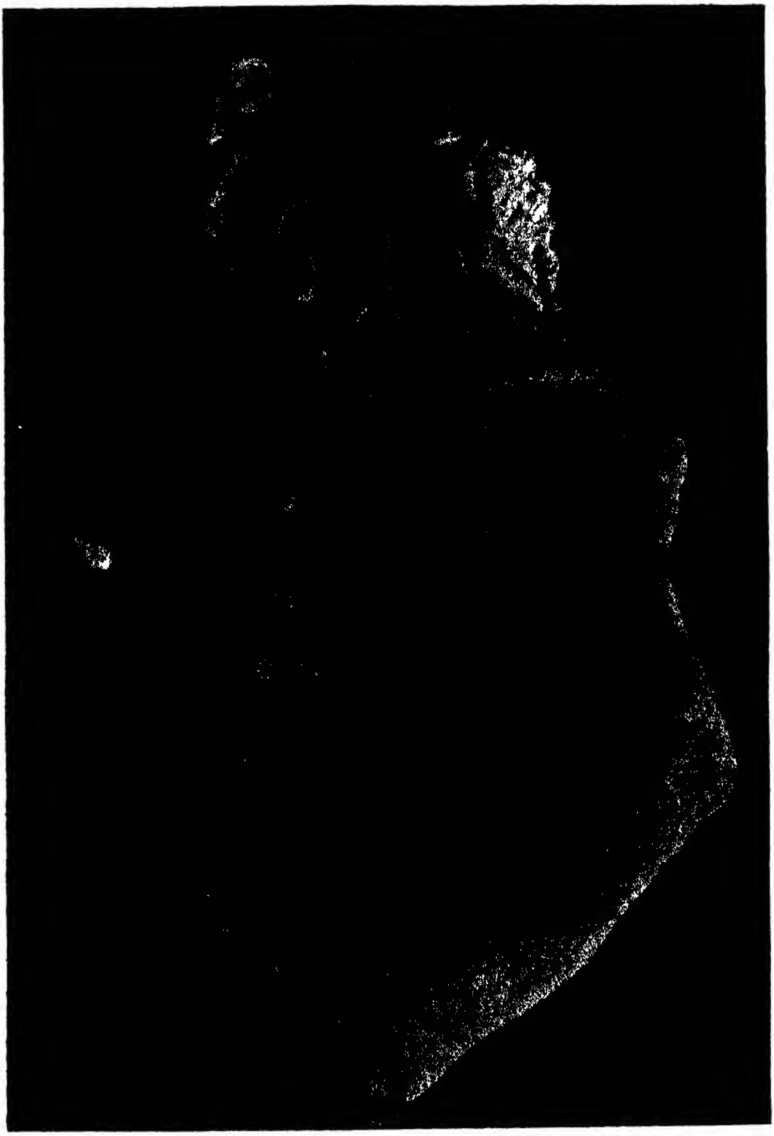
Period of Incubation.—The time elapsing between exposure to infection or inoculation and the development of symptoms may be placed at from six to fourteen days, but variations in either direction of this period may occur, as short a time as three days, and as long as thirty days, having at times been known to elapse. Such variations appear to depend, to some extent, on the prevalence of conditions which would be likely to diminish or increase the resisting power of the animal. For instance, during periods of extreme heat or excessive cold the period of incubation tends to be shortened.

Symptoms.—In ordinary cases the first symptoms noticed are listlessness, dullness, avoidance of movement, the pig lying hidden away in a secluded corner. Shivering fits may be noticed, and there is loss of appetite, great thirst, dull, anxious expression of countenance with drooping of the ears and tail, constipation with hard, rounded, glary, dark-coloured fœces, or sometimes fœtid diarrhœa. Attempts at vomition are also frequently observed in the early stages. These symptoms are, in the majority of cases, accompanied by the appearance of red hyperæmic blotches on different parts of the skin, giving the pig the appearance of having been splashed with red ink. (See Plate 1.) These blotches are effaceable, the redness dispersing on pressure, and the part remaining pallid until re-suffusion with blood occurs. Well-marked petechial spots or extravasations of blood, of a deep red or purple colour, occur on the ears, lips, nose, tail, belly, rump, inside of arms and thighs, and on the extremities. There is usually a discharge from the eyes and nostrils, at first thin and watery, but ultimately becoming sticky and purulent, and forming a dried concretion around the orifices. Later on the respirations become increased and laboured, and a cough is present, especially when there are lung complications; a fœtid diarrhœa succeeds the constipation, and the fœces may be blood-stained. As the disease advances, the gait of the animal is altered. He may be lame from sores about the fetlock and knuckles; there is gradual loss of co-ordination and control of the limbs, indicated by stiltiness and jerkiness of movement, particularly of the hind extremities, and if the animal lives sufficiently long partial paralysis succeeds. In the later stages the hæmorrhagic patches on the skin become necrosed, and sloughs or bedsores may form at points subject to pressure or injury. In black pigs the red blotching is not readily observed during life, but the practised eye may detect the skin changes in parts where there is little hair, by the shiny glossiness and deep-purple colour presented.

Duration of Disease.—Such would be a description of the general run of cases, and in these cases death may be expected at any time from seven days to three weeks or a month from the onset; but in some outbreaks the disease runs a more acute and rapidly fatal course, killing within a day or two; and in others, again, the disease assumes a chronic type, in which recovery may be protracted over three months.

Post-mortem Appearances.—Above everything, the appearances presented to the naked eye on *post-mortem* examination form the most reliable guide to diagnosis. Some of these are indicative of a general blood-poisoning, and others are special to the complaint. Particularly is this the case in regard to the ulceration found on the mucous lining in the neighbourhood of the ilio-cæcal valve at the junction of the large and small intestines. (See Plate 2.) The ulcers stand out prominently, and are composed of layers or rings of a dirty-white, brown, or black dead material. They are frequently round, and vary in size from a sixpenny

piece to a pin's head, but they may run together and form a large, irregular shaped ulceration. These ulcers may, in some cases, occur in other parts

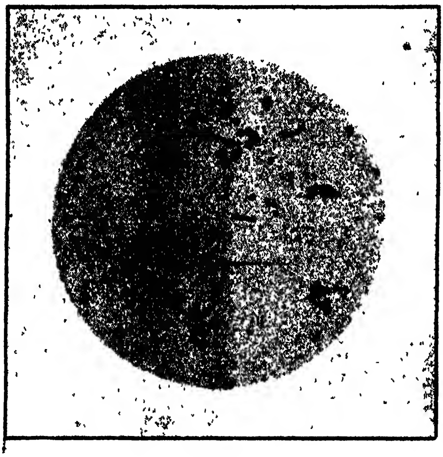


3. PORTION OF STOMACH OF PIG SHOWING INFLAMMATION OF MUCOUS MEMBRANE. SHADED PORTIONS WERE INTENSELY RED.

of the intestines, and while their presence may be taken as completely diagnostic of the disease, their absence, on the other hand, does not imply

that the animal is not affected with Swine Fever. Sometimes the ilio-cæcal valve is only slightly involved, but the mucous lining of the stomach may be deeply inflamed, presenting extensive hæmorrhagic patches and ecchymosis, while in some places it may be dead and sloughing. (See Plate 3.) The lungs may show a diffuse pneumonia, with ecchymosis and large hæmorrhagic patches. The liver is frequently swollen and ecchymosed. The kidneys may present the same appearance. The spleen is frequently unchanged to the naked eye, but in the spleen of some pigs there are hæmorrhagic nodulations on the surface, which give the organ a mottled appearance. The lymphatic glands throughout the body, but especially those receiving lymph from the parts where the most pronounced lesions exist, are congested, the congestion being most marked towards the surface.

BACTERIOLOGY.—Bacteriological tests are by no means so conclusive in forming a diagnosis in this disease as they are in many other infective diseases, or so reliable as the well-defined naked-eye appearances. The causative germ is a bacillus belonging to the fowl cholera group. (See Plate 4.) It is a short, oval, motile bacillus, from 1.2 to 1.5 microns



4. BACILLUS OF SWINE PLAGUE (X 1,000), STAINED WITH CARBOL-FUCHSIN.

long, and presents the other leading characterictics of its group (for which reference must be made to a work on bacteriology). It maintains its vitality and virulence in soil at ordinary temperatures for at least four months, and in water for a longer period. In the eminently suitable environment which the filthy and insanitary condition of the pigstye usually affords, it has been shown that the organism persists and remains infective for fully twelve months; and consequently it is a standing prophylactic rule that infected styes, yards, and paddocks must remain uninhabited by pigs for at least that length of time.

NOTE.—The plates illustrating this article have been previously used in an article by Dr. Brown, in the March, 1904, issue of the *Journal*, and were prepared from specimens kindly lent by Inspector Batchelor.—EDITOR.

Cow Pox.

(Variola Vaccinia).

Cow-pox is a specific, eruptive, febrile, and contagious disease of cattle, allied to small-pox in man, and characterized by the eruption on the udder and teats of vesicles and pustules. It has an incubative period of about four days, after which small, hard nodules appear under the reddened skin of the udder. Small blisters or vesicles then form at the nodulated parts, and are surrounded by a ring or areola, red and congested. About the eighth or tenth day these vesicles become transformed into pustules containing matter, and having a "pearly" appearance. The pustules dry up after two or three days, and are succeeded by a brown scab, which ultimately peels off, leaving a slightly depressed mark. The vesicle or pustule of true cow-pox may be distinguished from an ordinary sore by the fact that, at whatever stage, it has a depressed or "pitted" centre. The vesicles on the udder attain the size of a threepenny piece, and are circular in shape, while those on teats are usually oval. The disease is conveyed from cow to cow usually by the hands of the milker, so that it is advisable that healthy cows should not be milked by persons who have recently milked infected ones.

TREATMENT.—Beyond controlling aggravation of the sores by the usual treatment for sore teats or false cow-pox, little further attention is necessary, as cow pox is a benign disease, and runs a definite course without occasioning much constitutional disturbance. The milk, however, is rendered unfit for food, and may be a means of communicating the disease.

SILOS AND SILAGE.

A. S. Kenyon, C.E., Engineer for Agriculture.

The increase in the use of silage amongst dairymen and graziers is marked. Those who had silos put up last year are filling them again this year, and in many instances are erecting further ones, while the neighbours have seen enough to convince them of the profit arising from feeding with silage, and are also building. The vote of £1,000 granted this year for advances to farmers desirous of trying the experiment of silo feeding was quickly exhausted. A further sum of £1,000 was provided by the Honorable the Treasurer, and, with but half the year gone, sufficient applications have been received to exhaust this also.

Several farmers have given their experiences on the subject of silage, and these are worthy of perusal.

Mr. W. Hicks, Rutherglen, writes:—

I am pleased to say that I am more than pleased with the results. From 35 cows, 30 of them being on their first calves, for the month of November, our best spring month (without ensilage), my cheque was £32 2s. 6d.; in December started to feed ensilage, and received £25 18s. 6d.; for January, although cream was down ¼d. per lb., and no green grass whatever, the amount was £24 18s.; February, the weather still very dry, £23 15s.; March, £23 14s. 7d.; in April, my brother and I having bought a larger estate, we shifted our cows on to much better grass, but without the ensilage, the receipts fell to £17 10s. I have still about 2 feet in the silo, but have been unable to use it on account of it being so far away. We intend moving the silo when the roads get good, and if possible erecting another for the coming season. I filled the silo with Algerian oats off about 18 acres of ground; the crop was very light, and I cut it when it would make good green hay. I think the results would have been better if I had cut it a few days earlier. I estimate the weight in the silo at close on 60 tons; we feed at the rate of 25 lbs. per cow per day. I think

the better the chaff is cut the better the results. We broke the face of chaffcutter when about half-way up the silo, but we kept going for about an hour, and a lot of long straws went through, and when we came to them, when feeding this silage, it was not nearly so good in condition. I think, also, that builders of silos should be made to understand how necessary it is to tramp the stuff well while filling. I kept four men continually going, and for an hour or so a couple of times a day I had as many as eighteen school children as well. I had less than 2 cwt. of waste, but the result from a neighbouring silo was not nearly so good, and I think the whole trouble was not enough tramping.

Messrs. Tobin Brothers, Eskdale, say:—

The silo was filled with maize, chaffed, when the grain had just passed the milky stage; another silo was filled by us about a month later, but we consider the first made the better feed, as it was not so dry. About 6 acres sown with the drill, 35 inches between the rows, was enough to fill a [illegible]-ton silo. The cows are fed about 50 lbs. per day each, and eat it readily. In our opinion, the silo should have more posts in the foundation as the spans between the posts are too great for the bands, which have warped considerably. In building the second silo we put 16 posts round the circle instead of 8 in the silo built by your Department, and all who have seen it are of the opinion that it is more substantial.

The "warping" of the hoops between their supports on the foundation posts is due to leaving the studs unsupported at the bottom. They should have a block of wood, brick, or stone put under the centre one in each bay at least. The span is too long for a beam curved in plan.

Mr. A. Mountjoy, Dean's Marsh, states:—

The crop used for silage consisted of 10 acres of oats.

Stage of ripeness.—A little beyond the stage that it should have been cut for hay.

Amount put in silo.—About 50 tons.

It was fed to 60 cows (milkers), and lasted ten weeks.

The cows were badly affected with cripples, and the ensilage completely cured them, as during that time they did not get an ounce of bone-meal or salt.

The gain in quantity of milk was not much—2½ gallons per day for the lot, but the cows gained in condition. I think this was owing to the crop being too ripe when cut.

There is no doubt that this opinion is correct. The silage would be light weight, and comparatively low in food value, being cut so late; but its great merit as a cattle food is shown by its effect upon the health of the herd.

Mr. H. E. D. Kelly, Wodonga, relates:—

The silo was filled on 18th December, and took a day and a half to fill, a steam chaffcutter being used. The crop was a little too ripe when cut, owing to the delay in erection of silo. About 18 acres, about two-thirds wheat and one-third English barley, in the latter was a little Cape barley, were cut. The silo was filled to the top, and afterwards weighted with sand. It was opened on 15th May, and some waste around the edges was found.

Fed the dairy cows daily with about three-quarters of a bag each. During the flood there were only a few islands left, and only for the silo we would have had to move the cattle. Some cows were brought on from two pints to a gallon and a half per day.

Mr. H. Jacob, Mildura, gives some practical talk:—

In giving details of my experience of silage making and feeding, I may say that through several causes, namely, lateness in erecting silo, watering the land, rain, and breaking of chaffcutter, considerable delay was experienced in getting started. Notwithstanding this, the result has been very satisfactory, as everything is now in good running order, and I shall next time have things well under control.

The crop, about 1½ acres, was maize, planted in January. It was ready for cutting in April, but I could not cut it, as the silo was not completed till middle of May. By then we had some frosts, which bleached all the green out it; this left it dry and brown, only the cobs, which were perfectly ripe, being readily eatable. It was not till the first week in June that the cutting was finished.

The weight put into the silo was about 30 tons, but that amount was not there at one time, as I was feeding the cows from the silo during the filling, which spread over three weeks. When finished, it was 8 feet deep, and contained about 23 tons. I allowed each cow 30 lbs. weight per meal, fed in the morning. Previous to this they had green barley, but with the change to maize silage there was no falling-off in the milk. During the period of feeding every cow has been quite healthy. I allowed the horses 20 lbs. each, but they do not like it so well as the cows.

On the top of the silage I had about 6 inches of waste. The sides had an average of 1 foot all around, reaching down to the ground. I presume the air must get in through the sides. It was well trodden, but not weighted.

As the crop falls down it gets divided into three different grades. The heaviest, or grain, is thrown against the far side of silo; the stalk comes second, about the middle; leaves or flag third, and fall almost straight down. This means that it has to be mixed up again to make even feed. To prevent this take five chaff bags, cut the bottom open and sew them together, making a bag-chute 20 feet long, which should be hooked on to the top of elevator. The crop would then fall down without dividing. By sticking a hay fork into silage, and tying the side of chute to fork, it could be taken around the silo to any part which required it. As the silage rises, it could be rolled up and pinned with a few nails, keeping it about a yard above. It would save all trouble of levelling, as it would only be necessary to move the hay fork where required and fill up the hollows.

Mr. James Fair, Boweya, is satisfied: –

I filled the silo with about 10 acres of wheaten crop, cut when just in flower. It held about 45 tons, and I fed 40 lbs. a day to each cow. The results have proved very satisfactory, and it is without a doubt the best food for cows that I have tried.

Mr. J. C. Stehn, Morea, *via* Goroke, expects to get better results. He says: –

I did not keep any records of feeding. I used the silage for cows, horses, and sheep, and they were all very fond of it. It was good down the middle, but round the outside there was a great waste; on the whole there was about one-third waste, but I think that was because I put the iron on the wrong way. I started at the bottom, and kept the lap on the inside, and as the wet ran down the outside to the join it came in and spoilt the silage, but I intend to lap the iron the other way and fill it up again this year. I cut 14 acres of wheat when the flower was on it, but I think it would have been better to have cut it a little greener, as it would have pressed together better; I put in about 32 tons. I built it from the instructions taken out of the *Agricultural Journal*.

Messrs. Macdougall Brothers, Minyip, go fully into the question:—

It has proved eminently satisfactory, so much so that we feel satisfied that any farmer having stock to feed requires only to have the experience of its benefit to consider a silo an indispensable adjunct of his homestead. Our silo is built on the plans furnished by your Department—circular, 15 feet diameter by 37 ft. 6 in. in depth, 10 feet of this having been excavated and built with bricks laid in cement. It has a conical roof covered with ruberoid. Our first experiment in ensilage making was last season, when we built the first over-ground instalment of the silo 15 feet high, filled it with chaffed oaten hay, cut somewhat green, and weighted it with two waggon loads of sheaf hay, which, being built in the form of a cone, served the double purpose of a roof and a weighting. The quality of the ensilage, owing to insufficient weighting, was not as good as it should have been, being too black. Still, our milking cows ate it greedily, and so satisfied us that it was well worth our while increasing the size of the structure to its present dimensions. This season's filling was half Cape barley and half Algerian oats, both crops being cut somewhat on the green side. We filled it up to the top, and when it had sunk some 6 feet again filled it up, but applied no weights whatever. The result was that, for some 6 feet from the top, it had this calcined black appearance from overheating, and which we think should be avoided as far as possible in making ensilage. The balance, from this point downwards, was, we think, as perfect ensilage as could be made from the materials used. It had a rich light-brown appearance, and smelt similar to dried figs. We have fed it freely to milking cows, working bullocks, and horses, all classes doing equally well on it, and greedily fond of it. As we had

a good bulk of it, we did not feed to measure or weight, so cannot give any opinion on ration feeding, except the well-known fact in connexion with ensilage as a food, that it is very satisfying, and, though animals are greedily fond of it, yet they do not consume large quantities of it at a time. The lasting quality of feed made into ensilage is, in itself, a very high recommendation. Of course silos, no matter how economically built, cost money at the outset, but after two years' trial we feel sure that a general adoption of this mode of storing food will prove the only method of avoiding the heavy losses of stock from the periodical droughts to which we are subject.

The quantity of crop necessary to fill the silo was cut off a paddock of 15 acres, and we have been feeding it liberally to some 40 head of cattle for seven months. We are now within a few feet of the bottom.

Four silos were built in the Nhill district in conjunction with the local agricultural society. It was intended that the silage should be used specially for the purpose of feeding sheep; but, owing to the fact that the rain came earlier than usual last autumn, a good growth of grass came away before it was necessary to begin feeding the ewes on the silage. After the sheep had been feeding on the grass they refused to take to the silage, which was not of excellent quality. During the month of June steps were taken by an officer of the Department to see if it were not possible to induce the sheep to take kindly to the silage, but after persevering for about a month the attempt was given up without success.

The replies received from a number of other farmers who fed sheep successfully on silage last year seem to indicate that sheep will take readily to the silage, and do well on it, if feeding is started during the height of the hot, dry weather in the summer. It should be borne in mind, however, that it is often difficult to get sheep to change their habits of feeding, and therefore a first-class sample of silage, attractive in taste and smell, goes a long way towards insuring success.

Mr. R. G. Landry, Diapur, had mixed success and crops:—

I had the silo only half full, as it was not erected soon enough. Some rye, oats, and barley mixed, were stripped first, and then the straw put in, which filled about 2 feet. When it settled, the balance was filled with rye, peas, barley, and oats mixed, and a load or two of clean Algerian oats and one of white oats, weighted with logs of wood. About a week afterwards I put in about 6 tons of oaten straw, rather on the green side, and cut immediately after being stripped: this made very good feed. I commenced feeding 225 sheep on the 1st March, and continued until after the rain at the end of May, but did not keep a record of the weight; I should say about 240 lbs. per day were used. I was also feeding cows and young cattle. The top was all good silage, but when I got down about half-way it was mouldy all round the sides; about 4 inches next the iron were rotten, then about 9 or 12 inches were mouldy; but the cows seemed to like it the best. I think the layer of rye straw chaff in the bottom was the cause of it going mouldy. The ewes, all but twelve which had lambs, were dry; I cannot say the sheep did well, but if I had not got the silo I believe half of them would have died, as I had to take them 2 miles to water.

Mr. John Bond, Nhill, asks for suggestions:—

The crop cut was oats off about 20 acres. About one-fourth of the ensilage made the previous year was left in the silo. No account kept of weights fed to sheep or other stock. Our sheep did not care for the ensilage, owing to 1½ inches of rain falling in March, causing a spring in the grass. A dry spell then followed, when we tried them with silage mixed with chaff, then bran and also oats, but they stuck to the natural grass.

The loose horses and cattle, as well as the milking cows, have been fed all the winter. They come regularly night and morning to the silo to be fed, and are very fond of it, and it has maintained them in good condition with sleek coats.

We cut for silage about three days before we cut for hay. We find that from 5 to 6 inches, where the ensilage comes in contact with the iron, rots, though we had two men and a boy trampling whilst being filled; the horses and cattle do not reject it, but it cannot be so nutritious.

Is the heat of the sun on the iron the cause of this, and, if so, would a shield of weatherboard or ruberoid counteract it? I should be glad to hear other farmers' experience, as 6 inches on the outer circle of the ensilage mean a tidy lot.

Our intention is to re-fill every year and erect others, say, one silo to every 640 or 1,000 acres, when we shall feel insured against loss by drought.

There is no likelihood of the waste being due to the sun's heat. It is caused by excess of air—*i.e.*, oxygen—in the silage, and can only be avoided by well trampling and weighting the silage. The time of cutting also appears to have some bearing on the matter. Other experiences and practical suggestions will be welcome, as silage made from hollow-stalked cereals, such as oats, wheat, &c., is unusual in other countries; consequently we shall have to learn from our own mistakes.

Mr. Charles Bamford, Benalla, gives some useful details and suggestions:—

The silo that was erected by the Department on my farm last year was filled with a green crop of wheat, which, I think, was rather far advanced, as the flower had all fallen. In filling it I had the stuff carted from the binder to a steam chaffcutter, and was finished in four days within 1 foot of the top; three days after that I covered it down with 15 inches of earth. I took the temperature at different times for the first three weeks, and it never got above 110 degrees, but when I went to open it (six weeks after filling) it had risen to 135 degrees. On the top there was a mould about 15 inches deep, which was waste.

I started to feed about the middle of January, and out of 50 cows there were only about six that refused the first feed; it was six weeks before some of these took to it. Before I started to feed the cows on it I noticed a good many of them chewing bones, but after feeding for some time this had completely disappeared, which, I think, was owing to the scouring out they got. The feed did not appear to increase the yield of milk much, but arrested the fall, as I had as much milk at the middle of February as I had when I started. I fed 50 cows twice a day for one month, about 14 lbs. per feed, or 28 lbs. per day per cow, which would amount to about 18 tons 15 cwt.; and 40 cows for one month, same rate of feed, 15 tons; and one-third left in silo, 17 tons. Total, 50 tons 15 cwt. For improvements, I would suggest (1) that there be some kind of covering for the stuff when opened; perhaps it could be made out of lining boards, and made in quarters so one quarter could be used at a time; this would prevent the hot air having such a drying effect on it. (2) That there be doors on outside of port-holes. (3) That the roof be put on so it could be spouted.

Mr. James Baker, Gheringhap, writes:—

With regard to silage for the present season, I have used it for feeding young cattle rising two years. They were very fond of it, not leaving the silo all day for some time; but now, not getting so much, they go and feed during the afternoon, but always return to troughs to camp till morning. I have not used the silage as intended, as when planting the maize it was for feeding ewes and lambs; the rains having come before I had the silo erected, I did not attempt to feed the sheep, so fed the cattle and saved the grass for the sheep. It is my intention to use it for the sheep next year. I have a crop of barley growing at present, and will have maize later on.

The following particulars of the crop are furnished for your information:— Maize and ambercane. Maize, fair, ambercane good, planted in rows 28 inches apart. Acres cut, about 8, two of which were ambercane. Ripeness, maize nearly ripe, but was sprinkled with water, to which some molasses was added, which I had on hand; this is coming out in good order. Ambercane green, but well shot out. Amount put into silo, about 50 tons, according to table of capacity. Weights fed to cattle, for the first month 40 lbs., after that and now, 30 lbs. General observations or suggestions—None; do not at present see any room for improvements.

Mr. W. T. Hoare, Apsley, says:—

I fed over 500 ewes, as well as a small flock of stud merino rams, and found the results so satisfactory that I am erecting another silo; my example is being followed in the neighbourhood.

Steps are being taken this season to obtain, as far as possible, observations of the stage of ripeness when cutting, amount of consolidation, and

temperatures after filling, as these are the main points, particularly as regard the hollow-stalked crops, on which any doubt exists. For sheep feeding more care requires to be taken, as they will not readily take to anything but a good sample of silage. Cows are not so particular, but still inferior silage does not give full profit, it having, by excessive oxidization, lost some of its food value. Every effort should be directed towards getting the best sample possible. It will be well to repeat the instructions as to filling, which appeared in the *Year-book of Agriculture* for 1905:—

1. Before filling, whitewash the inside with a thick wash made of lime and skim milk. As this dries in a few minutes, it is sufficient to whitewash the iron each evening high enough to allow for next day's filling.

2. As the ports are placed in position, see that they fit closely all round. If necessary, use thin clay to lute the joint.

3. As the filling goes on, it is impossible to tramp it down too much, especially at the sides. Get the youngsters from the nearest school to spend a couple of hours in the silo each afternoon.

4. From 4 to 10 feet of filling a day is a satisfactory rate.

5. When full, wet the top layer of silage thoroughly. Then spread a layer of old cornsacks, and cover with at least 6 inches of sand or earth. This is specially required when the silage is made of one of the cereal crops, but it is not so necessary if maize or ambercane is used, although even then it is an advantage. A cover made of bags sewn together, and tarred, will last several seasons.

6. The shorter the stuff is cut, the better—½ inch is better than 1 inch.

7. The elevator requires to be driven slowly for a chain-belt elevator, but quickly for a blower.

8. The ordinary chaffcutter, with horseworks, will fill a small silo, but an engine is better for the larger sizes.

9. Arrange the work of filling so that the sheaves are carted direct from the binder to the cutter.

The lime washing is of the highest importance, and should on no account be omitted. Its purpose is mainly the preservation of the iron lining from the corroding juices of the silage. Cutting green stuff, particularly oats, with an ordinary chaffcutter, or even with the silage cutters, requires care and experience. Careful watch must be kept that the rollers do not get clogged. Feed around the edge of the silo, and trample there in particular; the middle will look after itself. Seal the top, unless feeding back is to take place at once, with a layer of straw chaff or other worthless material, well soaked with water, about 12 inches in thickness; and in the case of oats, wheat, &c., put on as much weight as practicable.

The best elevator, when properly made, is the chain and slat box elevator, driven from the bottom, preferably with chain and sprocket wheels. The up-shoot and down-shoot should both be completely closed in, so that any silage carried over is returned to the bottom without waste, and that none is blown away. The dimensions of the elevator should be about 12 inches in width and 4 inches in depth. The slats are 3 inches deep and 2 feet apart on the chain. The speed may vary from 180 to 240 feet per minute—that is, 3 to 4 feet per second. The cutter should, if possible, be placed so that the wheel, in revolving, throws the cut stuff in the direction the elevator is running. The chain elevator takes about ¼-horse power to drive it, and it will easily take up the full quantity cut by an ordinary-sized cutter, No. 1 or No. 2. The blowers attached to

the large American silage cutters take about 8-horse power to run them. Experiments are in hand to make a small blower capable of being driven by a horseworks along witn the usual type of chaffcutter.

The Editor will welcome any correspondence upon the subject of silage.

CLOSER SETTLEMENT STUDIES.

A WELL-MANAGED HERD OF COWS.

J. M. B. Connor, Dairy Supervisor.

It is evident that no one system of management can be laid down as a hard-and-fast rule to suit all farms, but, in the economy of the keep of the dairy herd, knowledge of the cardinal rules of breeding, feeding, and caretaking, and discretion in the application of that knowledge to daily practice, are amongst the very first essentials of success.

Messrs. Ralph Brothers, owners of the Hampton Park dairy farm, are, after fifteen years of careful selection and breeding, reaping the benefit of

RESULT OF CAREFUL BREEDING.

sound management in building up their present herd of beautiful animals. The farm is situated amongst the heath lands at Hampton, about ten miles S.E. of Melbourne, and within a few minutes of the railway station. The farm contains 195 acres, and is sub-divided into five paddocks, ranging from ten acres to 100 acres. Thirty acres are devoted to a practical system of growing a rotation of fodder crops, by intense cultivation, for summer and winter consumption for the dairy herd, the balance of the land being used for grazing the cows. The soil consists of a black sandy loam, with a limestone subsoil, and in its unimproved condition is thinly covered with bracken fern, heath, and light scrub.

The dairy herd consists of sixty-six cows, which average, when in full swing, ten to twelve quarts daily. At the present time (21st October) there

are fifty-four cows in milk, some of them giving over twenty quarts, yielding 550 quarts daily, which is retailed by four carts daily around Brighton and Sandringham. The cows are in the pink of condition, and are mostly crossbred Ayrshire and Jersey breeds. The present good qualities of the herd have been brought about by always using a pure-bred sire known to be descended from a milking strain on the dam's side, the first bull used to improve the breed being an Ayrshire. His stock was crossed with a pure Jersey bull, and the stock of the latter was re-crossed with an Ayrshire bull, and so on, every four years, re-crossing with these two breeds, and always using fresh blood. Care is always taken to obtain the best that can be purchased from a milking point of view, and it would be very hard to find a more even and nicer lot of dairy cows in the State. They show plenty of breeding, with beautifully shaped milk vessels, 75 per cent. of them being typical dairy cows in every sense of the word; their udders

INTERIOR OF MILKING SHED.

extend well forward along the belly, with plenty of width behind, and fill up every available space between the hind legs; the fine sloping fore quarter, razor-like wither, deep chest and body, with well-sprung hoop-like ribs, allowing plenty of room for storage of food, are all markedly manifest in this herd. This latter is an important point to note in buying a dairy cow, for if she has not the capacity for storing food, it is not to be expected that she can return large quantities of milk. The necessity of having good teats has not been lost sight of, and the whole herd is very uniform in this respect. They are rich brown in colour, the thickness being in proportion to the length of the teat, about 2½ inches. I noticed the legs short in comparison to the size of the bodies. Kind treatment and good feeding are features of management which inevitably rise to mind when looking at this docile, mellow, and sleek-coated herd of cows.

The milking shed consists of 37 bails, 4 feet wide by 8 feet long, with a 10-feet passage running down the centre, and a well-drained impervious brick floor laid in cement, drained on either side of the passage by a drain 12 inches wide by 3 inches deep, made of red-gum. The drainage runs into a large iron tank, which is emptied three times a week, and utilized in forcing the fodder crops. The shed is well lighted and ventilated by six glass windows along the roof, and one window at each end. It is lime-washed, and the floor is sprinkled daily with lime. Precautions are taken to keep the milk free from contamination. There is one lad employed to do nothing else but to feed the cows and wash their udders with warm water, and dry them. Between the milking of every two cows the men wash their hands, and the boy frequently changes the warm water; this is a treat to witness after the so-called fashion one daily sees on various dairy farms, where this important part

READY FOR DELIVERY.

of the business is carried out with about a gallon of water in a bucket or billy-can, as the case may be, which is used right throughout the milking without changing the water. Is it any wonder to find, when this dirty habit is practised, that sore teats are prevalent? It is the one sure way of carrying out unscientific inoculation of any disease one cow might be suffering from throughout the whole herd. No leg-ropes are used. Milking starts at 5 a.m., and about 4 p.m.; as soon as the milk is drawn from the cows, it is strained into 10-gallon cans, which are immediately taken away and placed in eight wooden vats, adjoining the ice-room, containing spring water from a well 45 feet deep. The cans remain in this cold water for half an hour. The vats are refilled at intervals; the water is pumped from the well into large iron tanks overhead by means of a 4-h.p. engine,

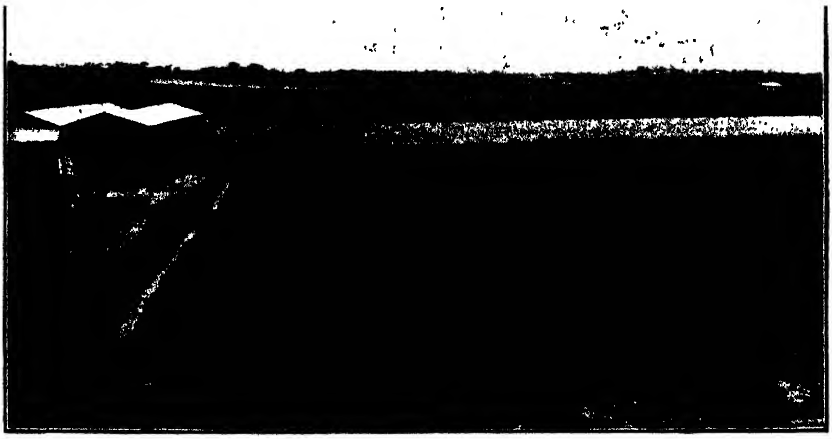
and is so cold that the pipes soon start to drip like a freezer. The milk is then stood in an ice-room ready for delivery. The same engine is used for scalding and steaming all buckets and milk cans, lifting water, cutting chaff, pulping and slicing mangolds, pumpkins, and carrots.

The owners are quite satisfied that the system of slicing and pulping all the roots gives the best results, and that there is no waste. The only feed purchased outside of what is grown on the farm works out at, on an average, 1s. 9d. per cow per week in the way of grains, and sometimes oat hulls. The process of feeding the cows is one bucketful of mixed chaff and grain first, then one bucketful of pulped mangolds, turkscaps, pumpkins, or whatever crop happens to be in season. This plan of feeding is adopted on account of the cows being so fond of the pulped roots that if this was fed first the chances are they would not look at the grains and chaff. The heifer calves, which look well, are all reared on skim milk, fed by the owners themselves. The milk is first scalded to 160 degrees Fah., and when cooled to 100 degrees is fed to the calves. They get nothing else—one gallon in the morning and about a quart at night. The owners are careful not to allow the calves to gorge themselves; their idea is to keep the calves growing, not to fatten them.

TYPICAL DAIRY COWS.

The thirty acres of land under cultivation, which produce the majority of the fodder, both for summer and winter consumption, for the dairy herd, are first manured at the rate of eight loads of farmyard manure and 7 cwt. of bonedust to the acre. Most of the manure is secured on the farm, with the exception of four lorry loads of stable manure, which are bought weekly at a cost of 27s. The owners recognise the importance of saving every available particle of manure, and look upon the cows as an essential factor in increasing the stock-carrying capacity of their farm, by supplying most of the manure required to keep up the fertility of the cultivation ground. The land is then deeply ploughed and broken up, and brought to a fine tilth. The last twelve months' crops consisted of the following:—Five acres of potatoes, planted during February for spring seed, and dug about May, and packed in fruit cases, so as to allow of free circulation of air, which causes the potatoes to shoot better, and the greener they turn in colour the better for seed; 8 acres of potatoes, planted on the 21st day of June, and dug at Christmas time, and fed to cows if selling cheaply; 3 acres of carrots (white Belgiums),

sown in September, in drills 2 ft. 6 in. apart and about 3 inches between each plant—these were pulped and fed to the cows during the months of May, June, and July, and returned 100 tons weight to the 3 acres; 10 acres mangolds, 20 tons to the acre (long red and yellow globe), the long reds were ready to start to feed in June, and the yellow globe fed through the spring and gave good results; 15 acres of maize (90 day), which is sown early in September and afterwards at intervals of every two weeks, so as to avoid the crop all ripening and coming in at the one time—it is ready for feeding purposes in January, and is fed (chaffed up with other foods) right up to end of May; 6 acres of rye, put in in February, and chaffed with other foods in season during September and October; 10 acres of oats and barley (5 acres of each), sown in March, and fed to the cows during October and November; 1 acre of Japanese millet (tried for the first time, and gave great satisfaction, all animals being very fond of it) was sown in October, and fed to the animals during January and February, and gave very heavy yield of bulky fodder. Two acres of maize, which grew to a height of 9 feet, were irrigated; this area was



FODDER CROPS.

sown at the rate of 1 bushel to the acre; drilled in every third furrow by hand with a drag hoe, and covered about 2 inches deep. This method has proved to be the best one for sowing maize, as it comes up uniformly, and allows the horse hoe to be worked between the rows to keep the surface soil free and open, keeping down weeds and conserving the moisture. This crop was irrigated at the cost of £10 for the season, and fed to the animals from January to the end of March. The owners assured me that two loads of the green succulent fodder at that trying time of the year more than compensated them for the expense they were put to for water rates, by allowing them to keep up the regular milk supply and the dairy herd in tip-top condition and good health.

Everything in the way of tinware used on the farm or coming into contact with the milk is thoroughly sterilized by steam, there being an elevated table with a steam jet in the centre; cans and buckets are tipped over this, and afterwards allowed to drain in a clean room set apart for that purpose.

STATISTICS.

Rainfall in Victoria.

Third Quarter, 1906.

Table showing average amount of rainfall in each of the 26 Basins or Regions constituting the State of Victoria for each month and the quarter, with corresponding monthly and quarterly averages for each Basin deduced from all available records to date.

Basin.	July.		August.		September.		Total for Third Quarter.	Average for Third Quarter.
	Amount, 1906.	Average.	Amount, 1906.	Average.	Amount, 1906.	Average.		
					*		*	
Glenelg and Wannon Rivers	5.21	2.91	3.31	3.10	2.38	2.71	10.90	8.72
Fitzroy, Eumerella, and Merri Rivers	5.32	3.37	3.43	3.19	2.88	3.08	11.63	9.63
Hopkins River and Mount Emu Creek	3.90	2.29	2.70	2.43	2.16	2.55	8.76	7.27
Mount Elephant and Lake Corangamite	4.45	1.90	2.34	2.34	2.80	2.39	9.59	6.63
Otway Forest	5.74	3.68	4.59	4.01	2.92	3.52	13.25	11.21
Moorabool and Barwon Rivers	3.05	2.31	3.04	2.38	3.46	2.60	9.55	7.29
Werribee and Saltwater Rivers	1.66	2.11	2.35	2.48	4.31	2.39	8.32	6.98
Yarra River and Dandenong Creek	3.39	3.10	3.18	3.06	3.67	3.26	10.24	9.42
Koo-wee-rup Swamp ...	3.90	2.94	3.25	2.94	3.58	3.26	10.73	9.14
South Gippsland	5.16	3.41	4.12	3.95	2.43	3.66	11.71	11.02
La Trobe and Thomson Rivers	3.89	2.71	3.65	3.53	1.75	3.36	9.29	9.60
Macallister and Avon Rivers	0.81	1.53	3.39	2.45	0.46	2.08	4.66	6.06
Mitchell River	0.98	1.91	3.30	2.65	2.02	2.33	6.30	6.89
Tambo and Nicholson Rivers	0.86	2.20	2.86	2.61	1.31	2.15	5.03	6.96
Snowy River	1.24	3.44	2.82	3.27	1.07	3.06	5.13	9.77
Murray River	1.99	1.86	2.40	2.26	3.10	1.83	7.49	5.95
Mitta Mitta and Kiewa Rivers	4.59	3.11	3.19	3.34	4.29	3.05	12.07	9.49
Ovens River	5.03	3.89	3.18	4.29	4.05	3.99	12.26	12.17
Goulburn River	3.33	2.34	2.80	2.83	3.89	2.31	10.02	7.48
Campaspe River	3.04	2.24	2.38	2.69	6.63	2.18	12.05	7.11
Loddon River	2.22	1.48	2.05	1.92	3.98	1.54	8.25	4.94
Avon and Richardson Rivers	1.97	1.28	1.69	1.68	2.03	1.33	5.69	4.29
Avoca River	1.96	1.42	1.84	1.74	1.88	1.35	5.68	4.51
Western Wimmera	4.22	2.14	2.36	2.27	2.69	1.84	9.27	6.25
Eastern Wimmera	3.21	2.16	2.46	2.37	1.64	1.88	7.31	6.41
Mallee Country	1.44	1.15	1.48	1.37	1.56	1.06	4.48	3.58
The whole State	2.94	2.21	2.59	2.51	2.61	2.21	8.14	6.93

* Figures in these columns are subject to alterations when the complete number of returns for September has been received.

P. BARACCHI,
Government Astronomer.

Perishable and Frozen Produce.

QUARTERS ENDING 30TH SEPTEMBER, 1906 AND 1905 RESPECTIVELY.

Description of Produce.		Exports from the State.		Deliveries from the Government Cool Stores.	
		1906.	1905.	1906.	1905.
Butter	lbs.	5,647,540	4,642,056	3,024,896	2,401,392
Cheese	"	235,080	180,120	44,078	...
Ham and Bacon ...	"	486,000	399,600	...	...
Milk and Cream ..	cases	4,043	4,715	160	25
Poultry	head	18,270	10,230	3,705	3,809
Eggs...	dozen	11,358	7,356	2,903	3,000
Mutton and Lamb	carcasses	8,937	24,421	5,504	10,980
Beef	quarters	2,065	159	...	...
Veal	carcasses	1,666	2,945	90	72
Pork...	"	745	173	497	43
Rabbits and Hares ..	pairs	1,793,548	2,023,440	478,440	687,496
Fruit	cases	7,483	7,836	835	42
" Pulp	"	839	372	...	...
Kidneys	dozen	..	...	...	820
Sundries	lbs.	...		6,537	3,177

R. CROWE,
Superintendent of Exports.

Fruit, Plants, Bulbs, Grain, &c.

IMPORTS AND EXPORTS INSPECTED DURING THE QUARTER ENDED 30TH SEPTEMBER, 1906.

Fruit, &c.	Imports.		Exports.		Fruit, &c.	Imports.		Exports.	
	Australasian.	Oversea.	Australasian.	Oversea.		Australasian.	Oversea.	Australasian.	Oversea.
Apples ...	13,089	20	369	225	Plants ...	392	100	127	—
Bananas, b/s.	83,184	—	—	—	Bulbs ...	—	158	—	—
Bananas, c/s.	3,870	1,713	854	—	Barley ...	6,144	—	—	—
Cucumbers	730	—	56	—	Beans ...	74	1,183	—	—
Lemons ...	10,912	—	—	232	Maize ...	3,159	—	—	—
Loquats ...	63	—	—	—	Nuts ...	117	960	—	—
Melons ...	—	—	70	—	Nutmegs ...	—	80	—	—
Mixed fruits	78	—	—	—	Oats ...	154	—	—	—
Oranges ...	181,785	—	2,248	80	Peas ...	1,149	20	—	—
Passion fruit	1,760	—	205	—	Potatoes ...	1,005	45	—	—
Pears ...	—	—	167	—	Rice ...	—	21,297	—	—
Persimmons	—	—	2	—	Seeds ...	787	45	—	—
Pineapples	6,835	—	533	—	Wheat ...	—	340	—	—
Plums ...	—	21	—	—	Yams ...	—	124	—	—
Strawberries	466	—	—	—					
Tomatoes ...	2,091	—	25	—	Totals ...	317,876	26,106	4,656	537

J. G. TURNER,
Inspector, Vegetation Diseases Acts, and Exported Products Act.

THE ORCHARD.

James Lang, Harcourt.

The usual routine work of the orchard should be pushed on; keep the scarifier going so that weeds may be destroyed and the surface kept loose and open. From reports to hand from various parts of the State, the fruit crop on the whole promises to be an average one. Frosts in the Bendigo and Castlemaine districts have destroyed a quantity of fruit, especially in those orchards which are situated on the banks of creeks and other low situations, consequently the average in these localities will be reduced. Complaints are also being made about the non-setting of the London Pippin; this is one of those varieties which bloom late, and is therefore in danger of being caught when in bloom by the hot winds. This happened last year, when the hot wind on Cup day destroyed the whole of the crop; it also happened this year, although not to the same extent, and owing to this cause there will be an extremely light crop of this variety all over the State. Pears are an average crop, William's Bon Chretien especially being a good crop; but peaches, apricots, and plums are below the average.

Reports of an unusual number of trees—cherries, apricots, and peaches—dying, have come to hand. This is no doubt caused by the exceptionally wet winter experienced north of the Dividing Range, in many orchards the roots of the trees were standing in water during the latter part of the winter. This shows the necessity for thorough drainage to carry off the stagnant water from the roots of the trees.

Spraying for the codlin moth will take up a good deal of time during the month. The arsenite of lead spray* is being greatly used in the Bendigo and Castlemaine districts, and seems to give satisfactory results to those growers who use it.. It is claimed for this spray that it does less injury to foliage than any other of the many arsenical sprays in use. The foliage of trees that are affected with red spider is more susceptible to burning than where the foliage is healthy. This can sometimes be seen on the same tree—where a branch is badly affected with red spider the leaves are burnt with the spray, while on the other parts of the tree not so affected, the foliage is clean and healthy, and the spray has no effect on it. The red spider does more damage and causes more loss in the orchard than many growers are aware of. The bandages on trees should be frequently looked over, and all codlin grubs destroyed. It will also be necessary to secure the young grafts on newly-grafted trees by tying them to stakes or by other means to prevent them from being blown off by the wind.

The Index of Vol. IV. will be supplied with the first number of Vol. V. viz.:—8th January, 1907.

"CLOSER SETTLEMENT ACT 1904."

STATE OF VICTORIA.

Digest of the Regulations Governing Allotments held under the Terms and Conditions of the Act.

Applicants for Conditional Purchase Leases must be of the full age of 21 years, and only one allotment can be granted to any one person, but the Board may at any time increase or decrease the area of any allotment.

Leases are granted for a period of 31½ years, or such lesser period as may be agreed upon, and are dated on the 1st day of March, June, September, and December, preceding the issue of the lease, or the permit for immediate occupation.

The maximum values of allotments which can be held under the provisions of the Act are—

Farm allotments, £1,500.
Agricultural labourers' allotments, £200.
Workmen's homes allotments, £100.

Exception is made in the case of "homestead" allotments, which may contain land to the maximum value of £4,000, exclusive of the value of the improvements.

The proclamation in the "Government Gazette," announcing that allotments are available, will also notify where plans, etc., may be inspected by intending applicants, the date up to which applications will be received, and the place and time of holding the Local Land Board to hear such applications, and the objections to them.

Applications must be made on the proper form, and an applicant may apply for several allotments on the same form, in priority of choice, the only amount of deposit required being that necessary for the most valuable allotment applied for. The questions on the form must be fully answered by the applicant himself to the best of his knowledge and belief.

The amount of the deposit necessary is 3 per cent. of the total value of allotment applied for, and must be accompanied by One pound (£1), being the fee for the preparation of the lease, and Five shillings (5s.) for registration fee. Unsuccessful applicants will have their deposits, etc., less the registration fee, immediately returned. Deposits must be made, either in cash, post-office order, postal notes, or bank draft, and forwarded to the Secretary to the Lands Purchase Board. Every applicant must personally attend the Local Land Board and produce documentary evidence of his assets (cash, plant, live stock, etc.), to show he has sufficient means to comply with the conditions of the lease. This evidence will be treated as private and confidential.

The officer appointed to conduct the investigation on behalf of the Board is authorized to administer the prescribed oath or affirmation to any person when obtaining evidence; and the evidence given by such person shall be taken down in writing, and signed by him, and countersigned by the officer.

Should the Lands Purchase Board consider further inquiry necessary before dealing with an application, it may require the applicant to appear before it for examination, or to supply the further information desired.

Preference may be given to an applicant who is landless over one who already owns land, or who occupies land with a right to acquire the fee-simple of it.

The amount of the deposit paid by the successful applicant will become the first half-yearly instalment, and subsequent instalments shall be payable, in advance, half-yearly, and be computed at the rate of 6 per cent. per annum on the total value of the allotment; payments may be made in advance at any time, and a proportionate reduction in the amount of interest secured thereby. The amount of the repayments, 6 per cent., is divided into two parts—4½ per cent. for interest, and the balance towards reduction of principal.

Upon payment of the valuation (if any) for improvements, a permit will be issued for immediate occupation.

Existing improvements at the date of the issue of the lease may be counted as effected improvements, providing the lessee has made payments thereon to the full value required by the terms of his lease. Repayments for such improvements, together with interest at the rate of 5 per cent. per annum, shall be payable in equal half-yearly instalments, in advance, over a period of not more than sixteen years, and as long as any portion of the purchase money remains unpaid, the lessee shall insure, at his own cost in all things, such improvements in an office approved by the Board, to their full insurable value, and deposit the policy with the Board; each ensuing receipt for the premiums for such insurance must also be lodged with the Board not later than the forenoon of the day on which the payment is due, the amount of such insurance may, by permission of the Board, be reduced from time to time, provided it is not reduced below the amount of the instalments remaining unpaid. Default in payment of any such instalments, or in any sums paid by the Board in respect of insurance, are recoverable in the same manner as default in payment of purchase money.

The lessee must reside on his allotment. Personal residence by the lessee's wife, or any of his children over eighteen years of age, or, if he has no wife or child over that age, by his father or mother, if dependent on him for support, may, with the approval of the Board, be considered personal residence by the lessee. Permission may be granted him to absent himself from his allotment for not more than four months in any one year.

The lessee must pay all rates, taxes, or assessments levied on or payable in respect of his allotment during the term of his lease, and fulfil all the conditions and covenants of the same. He must also keep in good repair all existing improvements, and must not destroy, pull down, or remove them without the permission of the Board. He must also plant such windbreaks and shade trees as may be specified, cut and trim all live fences on his allotment, and keep it free from all vermin and noxious plants; he must properly clean and clear from weeds, and keep open all creeks, drains, ditches, and water-courses upon his allotment, and also upon any reserve or road adjacent thereto; default in these respects may cause the work to be done by direction of the Board, and the cost of such work may be recovered in the same manner as purchase money. The Board, at any time, may enter upon, and make through any allotment any drain it deems necessary without any compensation to the lessee.

Each lessee shall forward to the Board, prior to the 31st July in each year, a report of the manner his allotment has been utilized for the twelve months ending the 30th June preceding the date of such report.

The right is reserved to the Crown to lay water-pipes, or to take water-races over the land, without compensation other than the reduction of purchase money in proportion to the value of the area taken when any such right has been exercised; and where any natural or artificial water-course runs on more allotments than one, each lessee on whose land such water-course runs shall have the reasonable use and enjoyment of the water, but may not alter, divert, or stop the water flowing therein, save to such extent as the Board deems advisable. The right is also reserved to the Crown to enter on the land, to search for, and take, and remove, gravel or stone for making and maintaining roads, the only compensation granted being for surface damage.

The lessee shall not cut down or remove any of the trees growing on the land demised, and unless the holder of a mining or a mineral lease, open up any mine without the consent of the Board in writing. A lessee cannot transfer, assign, mortgage, or sublet, the whole or any part of his allotment within the first six years of his lease, but in the case of the insolvency or the death of the lessee, a transfer may be made within twelve months of the date of such insolvency or death, to a person who is qualified to become a lessee under the Act.

The Board's certificate of compliance with the conditions of the lease as regards improvements must be obtained at the end of the first, third, and sixth years of the lease.

If the lessee makes default in the due observance of any of the conditions of his lease, the Board may, without any notice, forfeit such lease, and such forfeiture shall not release the lessee from any penalty or liability in respect of any thing done or omitted to be done by him.

The Crown grant for an allotment may be issued at any time after the expiration of twelve years from the date of the lease.

SPECIAL CONDITIONS.

Farm Allotments.

No conditional purchase lease of a farm allotment can be granted to any person who is already the holder of land in Victoria of the value of £1,500 (township land excepted), or who would thereby become the holder of land exceeding such value.

Improvements to the value of at least two instalments of the purchase money must be effected on each farm allotment before the end of the first year from the date of the lease, and 10 per cent. of the purchase money before the end of the third year, and a further 10 per cent. before the end of the sixth year. The allotment must be enclosed by a substantial fence within three years of the date of the lease, if not already done.

Agricultural Labourers' Allotments.

No conditional purchase lease of an Agricultural labourers' allotment can be granted to any person who is already the holder of land in Victoria of the value of £200, or who would thereby become the holder of land exceeding such value.

The necessary improvements to be effected are—Within one year from the date of the lease, a substantial dwelling-house, of the value of at least £30, must be erected, and, within two years, the allotment must be enclosed with a substantial fence.

Advances, on the £1 for £1 principle, may be obtained up to the sum of £50, to assist applicants in building and fencing. Such advances, together with 5 per cent. interest, must be repaid in equal half-yearly instalments, extending over a period not exceeding sixteen years.

Workmen's Homes Allotments.

A lease may be issued to any person engaged in some form of manual, clerical, or other work, for hire or reward, not at the date of application holding any land in Victoria, which, if town or suburban land, exceeds ⅛th of an acre in area, or if country land, exceeds 50 acres in area, or who does not possess real or personal estate which exceeds £250 in value.

Each applicant must possess the following qualifications:—

(1) That he is a workman, as defined in the previous paragraph.
(2) That he has the means to erect the improvements necessary, and repay any advance which may be made to him.
(3) That he is in all respects a deserving and suitable person

Failure to satisfy the Board on these points shall make the application void.

The improvements necessary are—Within one year from the date of the lease, a substantial dwelling-house to the value of at least £50 must be erected; and within two years from the date of the lease, further substantial improvements to the value of £25.

Advances, on the £1 for £1 principle, may be granted to assist in building, etc., to the amount of £50. Such advances, together with 5 per cent. interest thereon, must be repaid in equal half-yearly instalments, extending over a period not exceeding sixteen years

Supplement to Journal of the Department of Agriculture of Victoria, 8th January, 1906.

WYUNA SUBDIVISION.

SCHEDULE.

LIABLE TO SLIGHT MODIFICATIONS. SEE NOTE ON PLAN.

Lot.	Area.	Capital Value.	Deposit.	Lot.	Area.	Capital Value	Deposit.	Lot.	Area.	Capital Value	Deposit.
	Acres.				Acres.				Acres.		
1	330	£1,485	£45 16	48	170	£1,405	£43 8	95	99	£770	£24 7
2	310	1,395	43 2	49	94	800	25 5	96	149	1,155	35 18
3	173	1,040	32 9	50	94	800	25 5	97	131	1,015	31 14
4	185	1,110	34 11	51	94	800	25 5	98	140	1,085	33 16
5	170	1,020	31 17	52	103	875	27 10	99	126	945	29 12
6	162	1,215	37 14	53	103	875	27 10	100	129	970	30 7
7	164	1,230	38 3	54	103	875	27 10	101	128	960	30 1
8	205	1,230	38 8	55	103	875	27 10	102	131	915	28 14
9	226	1,320	40 17	56	34	290	9 19	103	131	915	28 14
10	147	1,100	34 5	57	24	205	7 8	104	127	955	29 18
11	142	1,035	32 6	58	20	170	6 7	105	80	560	18 1
12	207	1,450	41 15	59	20	170	6 7	106	17	120	4 17
13	24	190	6 19	60	20	170	6 7	107	121	845	26 12
14	24	190	6 19	61	20	170	6 7	108	88	615	19 14
15	24	190	6 19	62	20	170	6 7	109	147	1,030	32 3
16	24	190	6 19	63	285	1,140	35 9	110	25	175	6 10
17	24	190	6 19	64	285	1,140	35 9	111	130	975	30 10
18	24	190	6 19	65	283	990	30 19	112	124	930	29 3
19	145	1,090	33 19	66	225	1,350	41 15	113	113	850	26 15
20	140	1,050	32 15	67	225	1,350	41 15	114	117	880	27 13
21	138	820	25 17	68	210	1,365	42 4	115	120	900	28 5
22	250	850	26 15	69	283	990	30 19	116	310	1,085	33 16
23	167	875	27 10	70	320	1,280	39 13	117	285	1,140	35 9
24	300	1,500	46 5	71	340	1,020	31 17	118	200	900	28 5
25	272	1,225	38 0	72	751	1,385	42 16	119	120	960	30 1
26	227	1,020	31 17	73	417	1,460	45 1	120	95	715	22 14
27	274	1,235	38 6	74	424	1,485	45 16	121	80	600	19 5
28	264	1,450	44 15	75	423	1,480	45 13	122	62	530	17 3
29	187	1,495	46 2	76	423	1,480	45 13	123	62	530	17 3
30	220	1,500	46 5	77	423	1,480	45 13	124	75	640	20 9
31	276	1,240	38 9	78	228	1,025	32 0	125	75	450	14 15
32	261	1,120	34 17	79	227	1,140	35 9	126	440	2,200	67 5
33	310	1,085	33 16	80	229	1,200	37 5	127	65	555	17 18
34	310	1,085	33 16	81	93	700	22 5	128	60	510	16 11
35	205	1,025	32 0	82	109	820	25 17	129	55	470	15 7
36	63	535	17 6	83	122	915	28 14	130	42	355	11 18
37	84	715	22 14	84	124	930	29 3	131	50	425	14 0
38	155	930	29 3	85	138	1,070	33 7	132	58	495	16 2
39	100	1,200	37 5	86	121	845	26 12	133	62	525	17 0
40	135	1,150	35 15	87	311	1,245	38 12	134	58	495	16 2
41	95	810	25 11	88	253	1,075	33 10	135	80	640	20 9
42	132	1,120	34 17	89	156	1,090	33 19	136	62	525	17 0
43	132	1,120	34 17	90	186	1,115	34 14	137	100	850	26 15
44	160	1,360	42 1	91	117	905	28 8	138	85	725	23 0
45	160	1,360	42 1	92	120	930	29 3	139	100	850	26 15
46	125	1,030	32 3	93	121	940	29 9	140	180	1,440	44 9
47	160	1,320	40 17	94	116	900	28 5	141	140	1 120	34 17

No valuation for improvements has been placed on the Woolshed Allotment at Wyuna, as the building is to be dismantled, and the material sold in small lots to purchasers of allotments.

TERMS, CONDITIONS, ETC.

The leases issued to successful applicants will be dated the first day of March, 1906, and may be for such a term of years, not exceeding 31½, as may be agreed upon between the lessee and the Board.

An applicant may apply for more than one allotment, but will only be required to lodge one deposit, being the amount chargeable on the most valuable allotment applied for.

Only one allotment can be granted to any one person.

No conditional purchase lease of a farm allotment can be granted to any person who is already the holder of land of the value of £1,500 (township land excepted), or who would thereby become the holder of land exceeding such value.

Improvements to the value of at least two instalments of the purchase money must be effected on each farm allotment before the end of the first year from the date of the lease, and 10 per cent. of the purchase money before the end of the third year, and a further 10 per cent. before the end of the sixth year.

The lessee must reside on the allotment. (Personal residence by a wife, or any child not less than eighteen years of age, of lessee, may be considered personal residence by the lessee, with the approval of the Board.)

The lessee cannot transfer, assign, mortgage, or sublet the whole or any part of his allotment within the first six years of the lease.

The Crown grant may be issued to the lessee at the end of any half-year after the first twelve years have expired, on payment of the balance of purchase money.

Payments in advance may be made at any time at the option of the lessee, and proportionate reduction of interest secured thereby.

The purchase money, with interest at 4½ per cent., must be paid by 63 or a lesser number of half-yearly instalments (including deposit), calculated according to any of the tables under Division 3 of Part I. of the *Savings Banks Act* 1890 *Amendment Act* 1896. Each instalment will include interest upon the balance of the purchase money remaining unpaid.

Plans and further information may be obtained from the Closer Settlement Branch, Crown Lands Office.

J. MURRAY,
Commissioner of Crown Lands and Survey.

Department of Lands and Survey,
Melbourne, 19th December, 1905.

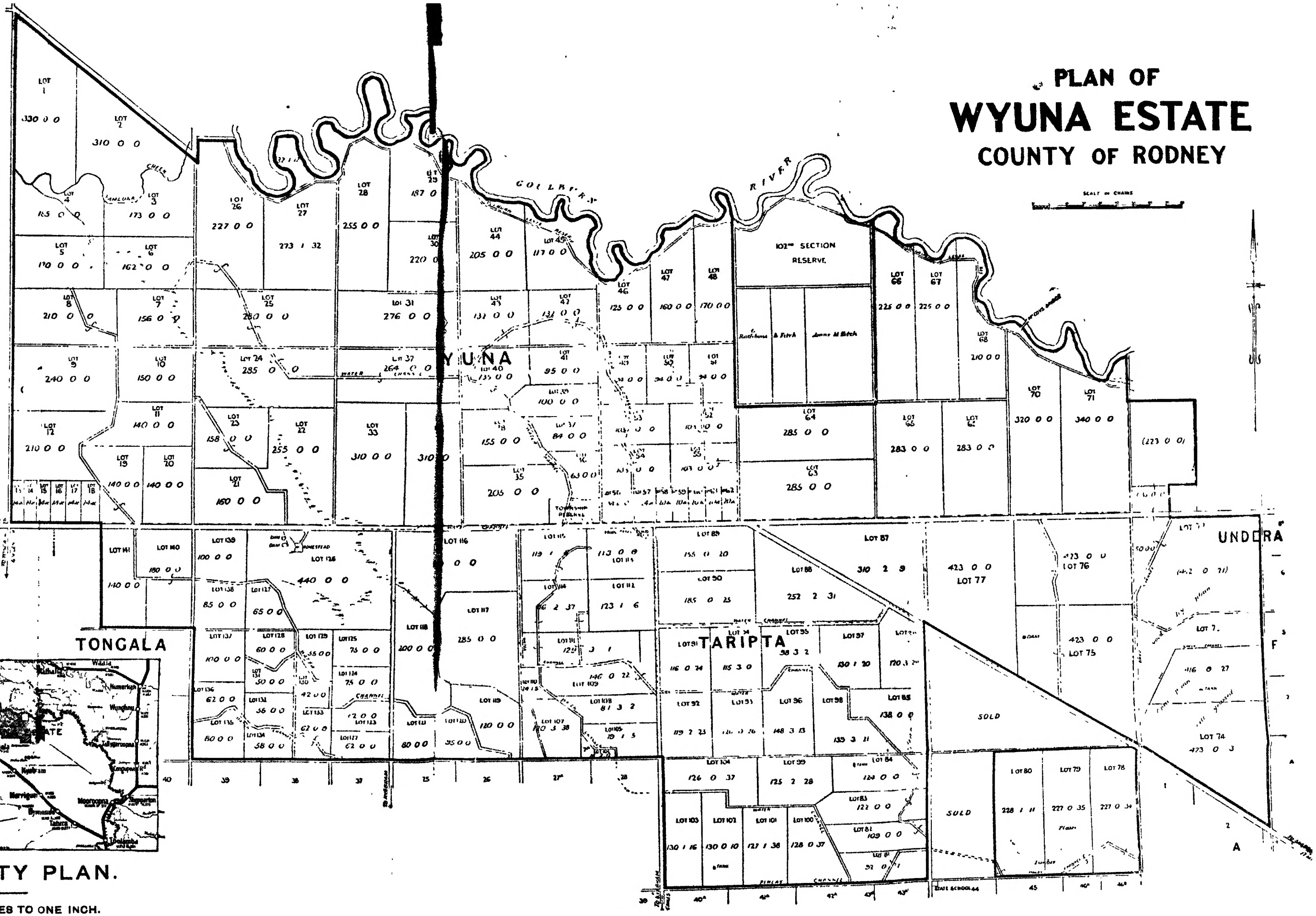
PLAN OF WYUNA ESTATE

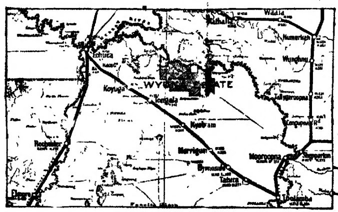
COUNTY OF RODNEY

NOTE.—This Plan shows the design approved by the Board, and the Schedule has been prepared from the latest data available, and both are subject to such minor alterations as may be found necessary when the whole survey is completed. Any slight alterations in area and value will be rectified at the Land Board, and deposits arranged accordingly

The complete water channels are not shown on this plan. Additions are being made so that every block will get water if not for irrigation at least for stock and domestic purposes

NOTE.—The Homestead Block, Lot 126, is reserved for an Agricultural College. Do not apply for it.





LOCALITY PLAN.

SCALE—16 MILES TO ONE INCH.